ENGINEERING NEWS-RECORD

AY 6, 1943

onstruction with
r and Concrete

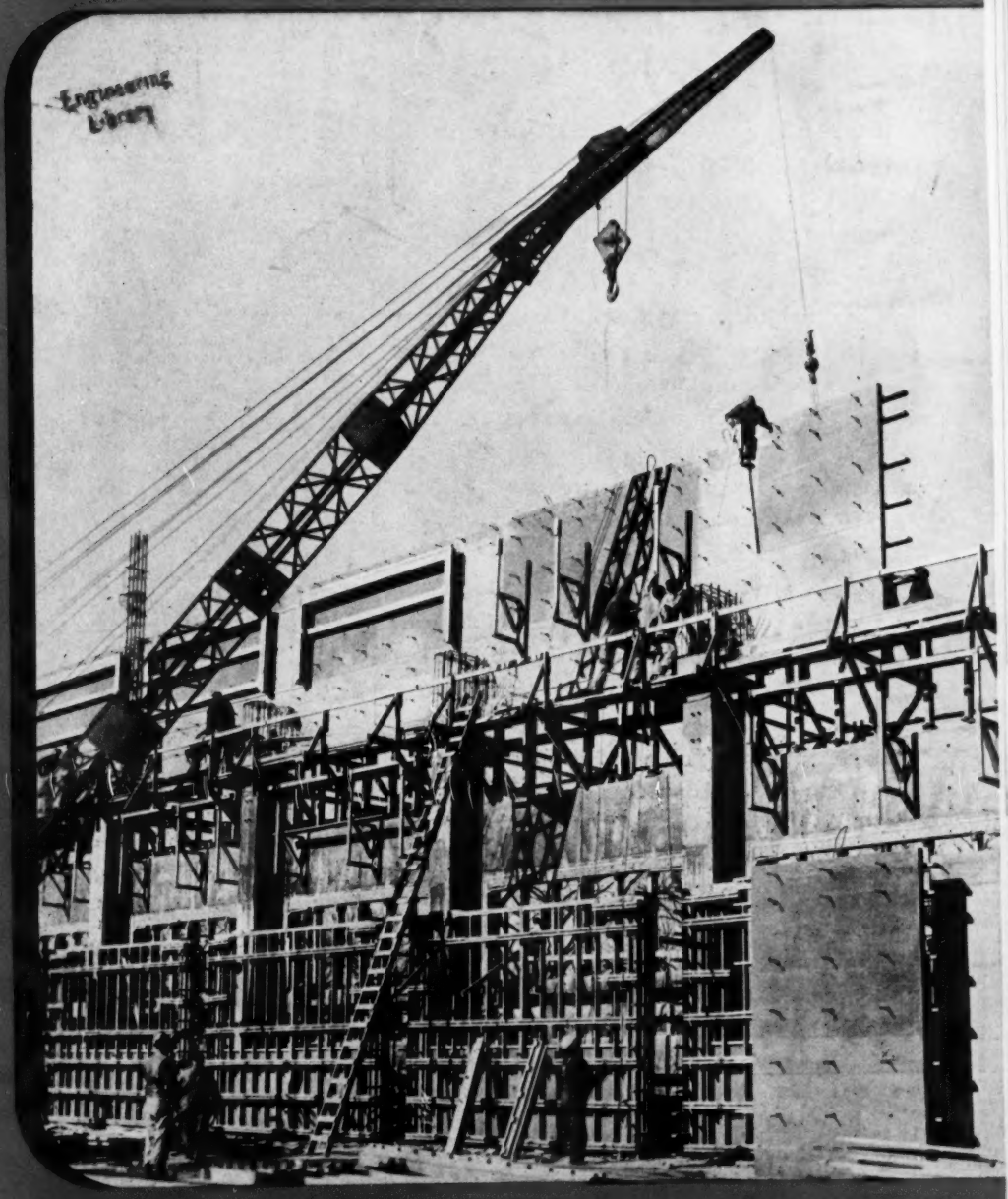
Frame Portable
for Combat Zones

le-Box Drain for
base Runoff

Lavatory Design
es Water Re-use

Foundations for
exican Bridge

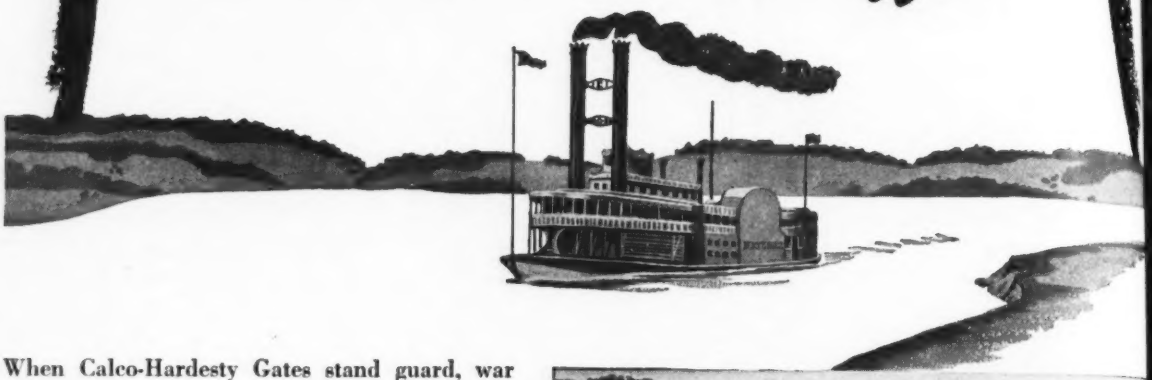
Engineering Library



Speeding concrete wall construction at a Mid-west war plant with the aid of 4x8-ft. forms faced with 3/4-in. plywood. (See story inside)

NOW OLD MAN RIVER

Can't "dilute" the War Effort



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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

...l. 130 MAY 6, 1943 No. 18

...OMING NEXT

The Navy's recent announcement ...lative to our cargo ship losses in ...42, and comparative figures on ...ip construction, means that our ...esent shipyards must break all ...oduction records previously es...blished if these losses, and those ...ticipated during 1943, are to be ...ercome. In *ENR* for May 20, one ... these yards, which is considered ...tstanding from the standpoint of ...yout, and many other unusual fea...res commensurate with fast pro...nction will be described.

Production of power for Canadian ...nd American war industries will be ...ncreased by a 1,500-ft. submerged ...eir being constructed above Niag...ra Falls to obtain maximum benefit ...om the water diverted around the ...alls. How this hazardous problem ...as solved will be outlined in the ...ay 20 issue.

To overcome problems incident to ...onstruction of an Army hospital ...ith the temperature at 20 deg. be...ow zero, five contractors on the ...ob used two distinct methods for ...rotection of concrete foundations, ...nd four different methods were em...loyed for constructing the building ...alls. In *ENR* for May 20 the ad...antages of each method will be ...iscussed and the disadvantages of ...ach will be outlined.

...OOKING AHEAD

• A bridge foundation problem of ...nusual interest concerns difficulties ...experienced with seepage of water ...nto sheet-pile cofferdams through a ...honey-combed limestone bedrock. ...Completion of the job was delayed ...for nearly a year. How the problem ...was solved by use of cement grout; ...the procedure followed in locating ...the water channels, and in sealing ...the fissures will be covered in an ...early issue of *ENR*.

• A method of solving continuous-...beam problems whereby the compu...tations involve linear equations only, ...will be outlined in an early issue of *ENR*. Analysis of typical beam load...ings are carried out and a special ...application of the method to the ...design of a wood sheet-pile dock ...wall is illustrated.

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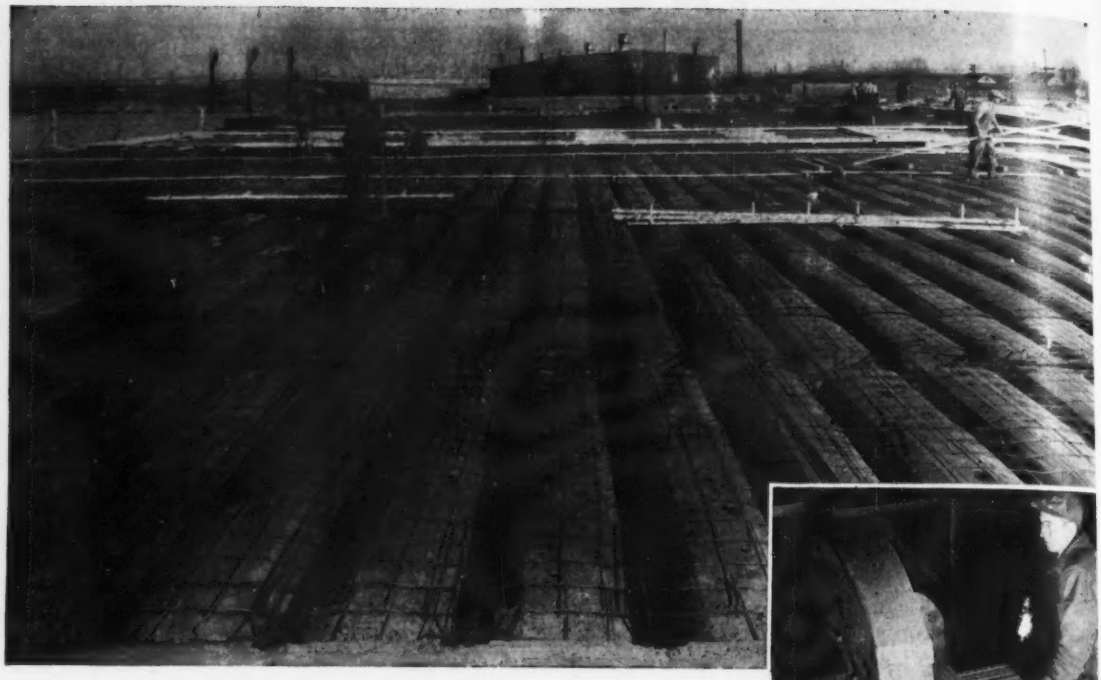

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MONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . . FHA MORTGAGES

(,000 omitted)	April 1942 (5 wk.)	April 1943 (5 wk.)	% Change	Four Months 1942 (18 wk.)	Four Months 1943 (17 wk.)	% Change†
ntinental U. S. Construction	$898,696	$379,068	−58.0	$2,891,784	$1,218,109	−55.0
vate Construction	63,732	45,710	−28.0	251,436	127,752	−46.0
lic Construction	834,964	333,358	−60.0	2,640,348	1,090,357	−56.0
deral	768,928	306,753	−60.0	2,408,613	1,034,601	−54.5
al New Productive Capital	$1,039,367	$416,561	−60.0	$2,458,821	$479,279	−79.0
vate Investment	40,253	9,166	−77.0	202,503	67,296	−65.0
deral (non-federal work)	16,114	7,045	−56.0	31,363	11,632	−61.0
deral (federal work)	983,000	400,350	−59.0	2,224,955	400,350	−81.0

† *Adjusted for difference in number of weeks reported.*

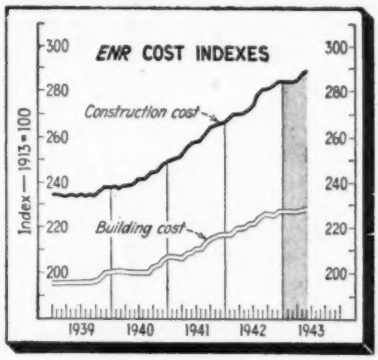
CONSTRUCTION COSTS . . . . WAGE RATES . . . . MATERIAL PRICES

	May 1942	May 1943	% Change	Changes April to May 1942 Apr.	1942 May	1942 %	1943 Apr.	1943 May	1943 %
NR Construction Cost Index, 1913 = 100‡	272.30	289.87	+6.5	271.78	272.30	+0.2	288.80	289.87	+0.4
NR Building Cost Index, 1913=100‡	220.14	227.64	+3.4	219.55	220.14	+0.3	227.50	227.64	+0.1

‡ *Does not reflect increased costs due to more overtime, lower labor efficiency, delivery, delays, etc.*

ENR 20-CITIES' AVERAGE

mmon Labor	$0.788	$0.863	+9.5	$0.788	$0.788	0	$0.858	$0.863	+0.6
illed Labor (Av. 3 trades)	1.542	1.614	+4.7	1.541	1.542	+0.1	1.613	1.614	+0.1
icklayers	1.645	1.703	+3.5	1.645	1.645	0	1.703	1.703	0
ructural Ironworkers	1.602	1.671	+4.3	1.602	1.602	0	1.671	1.671	0
rpenters	1.379	1.468	+6.5	1.376	1.379	+0.2	1.465	1.468	+0.2
ment, per barrel	$2.60	$2.61	+0.4	$2.60	$2.60	0	$2.61	$2.61	0
inforcing steel cwt.	2.67	2.74	+2.6	2.62	2.67	+1.9	2.74	2.74	0
ruct. steel shapes, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
nd, per ton	1.19	1.21	+1.7	1.21	1.19	−1.7	1.21	1.21	0
mber, 2x4 Fir, per M ft.	48.30	50.88	+5.3	47.88	48.30	+0.9	51.05	50.88	−0.3
mber, 2x4 Pine, per M ft.	42.82	44.97	+5.0	42.29	42.82	+1.3	44.66	44.97	+0.7
ick, common, per M	15.41	15.68	+1.8	15.33	15.41	+0.5	15.63	15.68	+0.3
eady-mixed concrete c.y.	7.33	7.37	+0.5	7.19	7.33	+1.9	7.37	7.37	0
ruct. clay tile, 3x12x12	76.72	78.97	+0.3	76.62	76.72	+0.1	78.93	78.97	+0.1
ving asphalt, cars, ton	14.93	15.32	+2.6	15.36	14.93	−2.8	15.21	15.32	+0.7



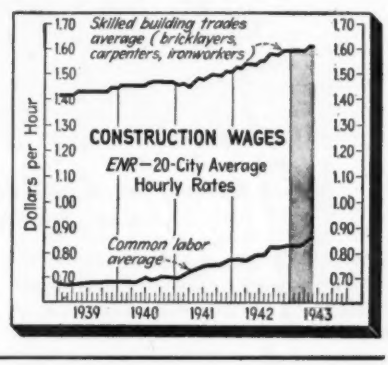
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
May, 1943	289.87	139.34	227.64	123.06	...	...
April, 1943	288.80	138.83	227.50	122.98	225	99
Mar., 1943	285.24	137.11	226.66	122.53	228	100
Feb., 1943	283.48	136.27	226.90	122.66	231	101
Jan., 1943	283.45	136.25	226.87	122.64	172	76
Dec., 1942	283.69	136.37	226.63	122.51	227	100
Nov., 1942	283.64	136.35	226.58	122.48	462	202
Oct., 1942	282.44	135.77	225.90	122.11	421	185
Sept., 1942	281.61	135.37	225.46	121.88	544	238
Aug., 1942	281.61	135.37	225.39	121.84	622	273
July, 1942	277.65	133.46	223.45	120.79	736	323
June, 1942	274.19	131.80	221.18	119.56	752	330
May, 1942	272.30	130.89	220.14	119.00	821	360
April, 1942	271.78	130.64	219.55	118.68	569	249
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118
1939 (Av.)	235.51	113.21	197.44	106.73	211	92

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	April 1942	April 1943	% Change	Mar. 1943	% Change Mar.-Apr.
el (% operating capacity) A.I.S.I.	98.1	99.4	+1.3	99.3	+0.1

	March 1942	March 1943	% Change	Three Months 1942	Three Months 1943	% Change
bricated Structural Steel, tons, A.I.S.C.	191,262	111,606	−41.7	523,614	324,483	−37.9
ment, thous. bbl., U. S. B. of M.	12,563	10,108	−19.5	29,971	27,405	−8.6
ilding Permits, Dun & Bradstreet (,000 omitted)	$102,746	$34,780	−66.1	$253,635	$92,236	−63.6



COST OF LIVING INDEXES . . . . EMPLOYMENT

	March 1942	March 1943	% Change	Feb. 1943	% Change Feb.-Mar.
ost of Living Index, N.I.C.B.	96.1	102.8	+7.0	101.8	+1.0
ent (Housing) Index, N.I.C.B.	90.7	90.8	+0.1	90.8	0
otal Employment (est.) thous., B.L.S.	35,411	38,146	+8.0	37,958	+0.5
onstruction Employment (est.) thous., B.L.S.	1,625	1,331	−18.0	1,386	−4.0

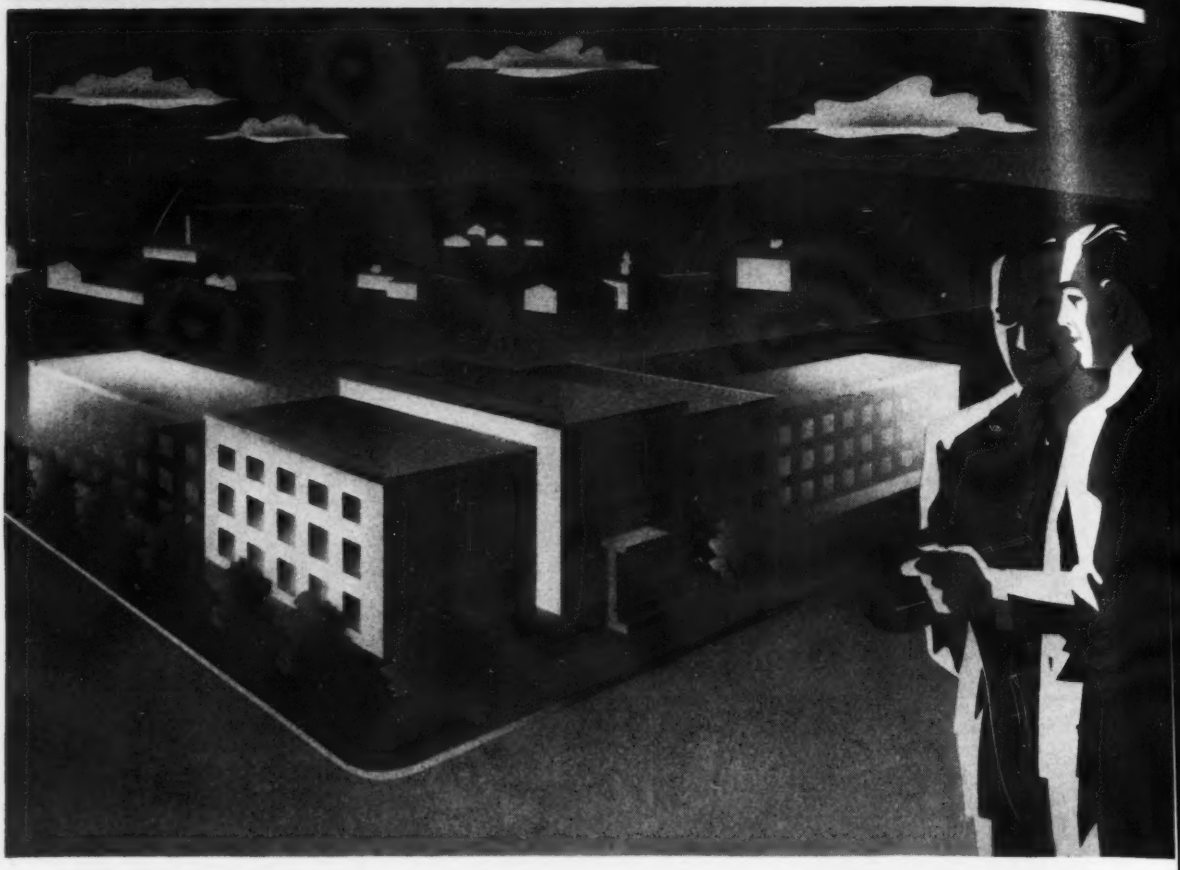
ENGINEERING CONSTRUCTION CONTRACTS——ENGINEERING NEWS-RECORD——APRIL, 1943

Engineering News-Record *reports continental U. S. construction projects of the following minimum costs—waterworks excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Five Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States April 1943	United States Four Months 1943	United States Four Months 1942	Canada
Public Works										
Waterworks	307	1,047	2,064	1,450	1,196	727	6,791	18,468	35,464	95
Sewerage	22	243	739	636	632	1,109	3,381	13,365	29,682	.....
Bridges, public	50	164	268	1,340	80	546	2,448	7,353	21,936	450
Earthwork and waterways	175	3,947	1,240	32	1,269	165	6,828	11,445	163,323	.....
Streets and roads	100	4,955	7,078	9,973	4,543	1,833	28,482	64,637	134,577	1,753
Buildings, public	9,713	12,862	38,754	25,673	37,021	49,473	173,496	633,276	1,825,025	3,353
Unclassified, public	1,665	29,309	34,585	8,030	20,630	17,713	111,932	341,813	430,341	1,654
Total public	**12,032**	**52,527**	**84,728**	**47,134**	**65,371**	**71,566**	**333,358**	**1,090,357**	**2,640,348**	**7,305**
Federal government (included in above classifications)	11,651	44,987	80,631	37,149	62,928	69,407	306,753	1,034,601	2,408,613	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	1,550	205	.....
Industrial buildings	1,060	207	2,150	1,962	562	789	6,730	44,674	101,908	1,038
Commercial buildings	3,613	11,344	7,742	2,386	3,354	6,163	34,602	69,835	124,298	150
Unclassified, public	130	175	25	3,254	459	335	4,378	11,693	25,025	40
Total private	**4,803**	**11,726**	**9,917**	**7,602**	**4,375**	**7,287**	**45,710**	**127,752**	**251,436**	**1,228**
Total Engineering Construction										
April, 1943 — 5 weeks	**16,835**	**64,253**	**94,645**	**54,736**	**69,746**	**78,853**	**379,068**	.....	.....	**8,533**
March, 1943 — 4 weeks	9,763	49,315	54,236	30,879	84,941	76,839	305,973	.....	.....	8,183
April, 1942 — 5 weeks	57,241	126,783	149,323	200,908	141,735	222,706	898,696	.....	.....	20,546
Four Months — 1943	**53,515**	**165,888**	**277,960**	**139,956**	**277,046**	**303,744**	.....	**1,218,109**	.....	**31,617**
Four Month — 1942	126,803	442,313	665,024	518,120	606,433	533,091	.....	.....	2,891,784	52,266

Picture of a hospital growing wings



More hospital space is needed—immediately. How would you get the additional wings for this hospital up and ready for use in the quickest possible time?

ONE WAY to speed wartime construction on this job—and many others—is to use Atlas High-Early cement. Specify it for foundations, floors, columns, walls. Wherever you would use ordinary portland cement, Atlas High-Early will do the job in less than the usual time.

If you want to get a "Rush" job off to a flying start, *begin* with this speedy cement. Then if unforeseen delays occur, you'll be better able to meet the completion date on time. Or, if the job is under way and has been unavoidably slowed up, call on High-Early to help you make up lost time.

For every wartime construction job that demands *speed*... airports, cantonments, factories, housing, bridges, roads and hospitals... specify Atlas High-Early. You can rely on it to give you durable, serviceable concrete... *in a hurry.*

Check over the five facts listed in the adjoining box. Use Atlas High-Early cement, and save valuable time, manpower and equipment. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

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for Wartime Construction

Atlas High-Early cement gains strength rapidly —produces serviceable concrete in one-fifth the usual time on some jobs. So it—

1. ***Permits earlier use*** of concrete, and thus gives owner earlier occupancy.
2. ***Saves manpower*** when such conservation is needed most—releases men for new jobs more quickly.
3. ***Conserves lumber.*** Forms may be stripped sooner—often in 24 hours instead of from 3 to 5 days—and re-used. Hence fewer sets of forms may be needed, saving time, labor and lumber.
4. ***Shortens time required for protection and curing*** as much as 70%.
5. ***Reduces overhead*** by saving time, manpower and equipment.

ENR-H-84

SAVE TIME IN WARTIME WITH

Atlas High-Early Cement

A UNIVERSAL ATLAS PRODUCT

The Week In Engineering and Construction

GINEERING NEWS-RECORD • MAY 6, 1943 • VOLUME 130 • NUMBER 18

Federal postwar public works totals nearly eight billions

Program is largely an inventory, however, and those projects on a ready-to-go basis reach a total of less than one billion; much advance planning is required.

Federal public works projects that ght be available for postwar construc- n totalled $7,695,369,000 at the turn the year according to the annual re- rt of the National Resources Planning ard, which was released to the public t week.

This figure includes unfinished por- ns of projects halted by the War Pro- ction Board, projects authorized by ngress, projects that have been recom- ended by various federal agencies, and ojects that are receiving preliminary udy. The total does not include muni- al and state projects eligible for deral-aid participation.

For some years now, NRPB has been harged by the President with the annual preparation of an advance program of public works covering the next six years. Projects are supposed to be collected from the various federal construction agencies, and duplication is eliminated by the board.

Projects listed by type

War conditions made such a job impracticable this year, and the Board has instead assembled projects held in abeyance by federal agencies until after the war. In the table on the following page is listed the totals obtained in each category, according to the various types of projects.

Few of the projects, even of those

(*Continued on page* 86)

Irving Subway Grating Co.

Creating "Bridge of Sighs" for Enemy

Army air-borne engineers have developed nother new use for steel portable emergency irplane landing mats, as evidenced by this emporary bridge built in fast time over a wamp at a United States army air base. ransports and glider planes flew in the construction materials, primarily open-mesh steel grating mats and wooden stringers. This type of matting has been used extensively for "pocket airfields" at the fighting fronts and for emergency roadways. Bridges built in this manner facilitates passage of heavy equipment.

WPB issues new list of critical materials

A new list of the current status of materials used in war and essential civilian production has been issued by the War Production Board under the title "Material Substitutions and Supply List—Issue No. 8." In the list the materials are divided into three groups: Group I, materials which are insufficient in supply either for war demands or for civilian needs; Group II, materials which are just sufficient for war and essential civilian production; Group III, materials for which there is an excess that can be used as a substitute for other critical materials.

With respect to steel, which is the most important of the critical materials in the construction field, the new report states that there are enough steel ingots for all current war needs, and approximately enough for essential civilian needs where special factors, like safety, are important. Now in Group II under steel products are black plate, pipe, rails, structural steel, piling, wire mesh reinforcing, reinforcing bars and rerolled rail products.

In structural lumber, still in the critical list is Douglas Fir (all grades No. 2 and better—all board—thick clears—dimension); Eastern Spruce (No. 1, No. 2, No. 3, No. 4); Eastern White Pine (Selects, No. 1, No. 2, No. 3, No. 4); Idaho White Pine (No. 2, No. 3, No. 4); Northern White Pine (No. 2 boards, No. 3 boards, No. 4 boards); Norway Pine (No. 2, No. 3); Southern Pine (Stress grade No. 2 boards).

Asphalt is in Group II, as is high-flash naphtha-solvent coal tar. Coal tar pitch is in Group III.

• • •

TVA engineers redesign power plants for Russia

Engineers of the Tennessee Valley Authority are now engaged on the design of two small hydro-electric power plants for the Russian government on an assignment from the Procurement Division of the Treasury Department under the lend-lease law. The equipment for these plants originally was designed for installation in Java but it is now being redesigned by the engineers of the TVA for installation in Russia.

Eight billion dollars for postwar public works

(*Continued from page* 85)

which are authorized, have plans and surveys in such shape as to permit them to get going quickly. It is estimated by NRPB that less than a billion dollars worth of these projects are in shape to permit prompt action. Another measure of the immediate postwar value of the listed projects is the extent to which they include work that can be done "by the yard"—started quickly and stopped without destroying the value of work already done. About two billion fall in this category.

There is wide variation among the federal agencies as to the extent to which they are getting projects into shape. The Army Corps of Engineers, for instance, has a $2,000,000 appropriation for advance planning this year, and a similar amount is included in its pending civil functions appropriation. If this goes through, they will have nearly all their authorized flood control projects on a ready-to-go basis by the end of 1944 fiscal year.

On the other hand, the Forest Service, which has a $140,000,000 forest trails program under contemplation, has authorizations for only $2,500,000, and thus is debarred from much advance planning. Similarly, the CAA's 3,100-airport postwar program, amounting to some $310,000,000, has not been authorized and therefore sites have not even been selected.

PROGRAM OF POST-WAR CONSTRUCTION AND IMPROVEMENT WORKS OF THE FEDERAL CONSTRUCTION AGENCIES—JAN. 1, 1943

Purpose classification	Estimated cost authorized projects or those requiring only Presidential authorization to undertake [1]	Estimated cost of projects requiring future congressional authorization	Tentative estimated cost of projects involved in surveys now under way or authorized	Total estimated cost of all projects
LAND DEVELOPMENT AND PROTECTION				
Flood control	$666,820,283	$832,216,379	$500,000,000	$1,999,036,662
Irrigation and reclamation	1,087,535,182	.....	500,000,000	1,587,535,182
Forest development	73,702,420	152,537,493	.....	226,239,913
Park development	55,852,111	.....	.....	55,852,111
Range land development	128,419,807	.....	.....	128,419,807
Wildlife development	9,405,250	.....	.....	9,405,250
Soil conservation	6,308,249	131,000	.....	6,439,249
Total, land development and protection	2,028,043,302	984,884,872	1,000,000,000	4,012,928,174
PROMOTION OF TRANSPORTATION				
Rivers and harbors	221,949,340	675,519,346	150,000,000	1,047,468,686
Aids and assistance to navigation	44,247,147	.....	.....	44,247,147
Airports and airways	33,422,000	311,717,812	.....	345,139,812
Roads	82,771,895	472,139,733	.....	554,911,628
Railroads	648,167	.....	.....	648,167
Total, promotion of transportation	383,038,549	1,459,376,891	150,000,000	1,992,415,440
POWER GENERATION AND DISTRIBUTION [2]				
Dams and power plants	106,402,000	605,311,000	200,000,000	911,713,000
Transmission lines	128,297,000	66,460,000	.....	194,757,000
Total, power generation and distribution	234,699,000	671,771,000	200,000,000	1,106,470,000
EDUCATION				
Total, education	4,931,804	13,538,362	.....	18,470,166
WELFARE AND HEALTH				
Welfare	38,579,401	62,424,000	.....	101,003,401
Health	25,382,500	15,820,970	.....	41,203,470
Penal and correctional	30,100,260	.....	.....	30,100,260
Total, welfare and health	94,062,161	78,244,970	.....	172,307,131
SANITATION AND WATER SUPPLY				
Total, sanitation and water supply	14,443,400	10,068,915	.....	24,512,315
GOVERNMENT ADMINISTRATION				
Office buildings	156,690,000	7,265,000	.....	163,955,000
Post offices and courthouses	37,500,000	131,948,000	.....	169,448,000
Facilities for law enforcement	1,086,000	13,041,000	.....	14,127,000
Research facilities	12,167,700	8,568,280	.....	20,735,980
Total, Government administration	207,443,700	160,822,280	.....	368,265,980
Total, all purposes	2,966,661,916	3,378,707,290	1,350,000,000	7,695,369,206

[1] Includes additional cost required after fiscal year 1944 to complete projects for which expenditures will be made in fiscal year 1944; also new projects available for construction; also includes cost to complete projects partly constructed but now deferred because of the war.

[2] This estimate excludes hydroelectric power projects included in other purpose classifications.

Cost of Pentagon Buildi... double original estimate

The cost of the War Departme... new Pentagon building, said to be t... largest office building in the wor... located across the Potomac River fr... Washington in Arlington, Va., is m... than twice the original estimate it w... revealed in figures made public May ... the first anniversary of the occupan... of the building. The latest offici... estimated cost of the building, ... landscaping and approaches was $... 454,583, although the War Departme... on Oct. 7, 1941, had estimated the co... at approximately $31,100,000 on a co... plus-fixed-fee contract basis.

No new explanation is given of t... increased cost of the building—mo... than 100 percent in excess of the es... mate of eighteen months ago. Pre... ously it had been stated that the co... would be higher than the estimate ... account of the higher cost of critic... materials and labor, and the speed pr... sure that accounted for its completi... six months ahead of schedule.

• • •

WPB stop order lifted o... Texas flood control job

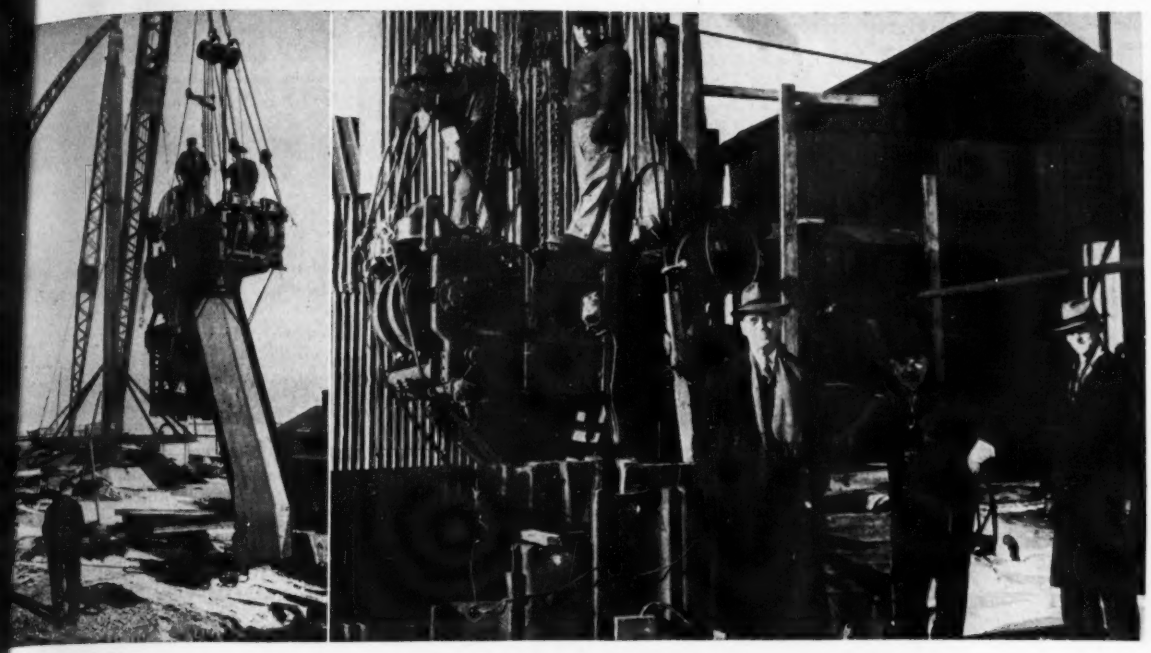
The War Production Board has lift... its stop order on the $1,233,000 Bark... Dam flood control project at Buff... Bayou, Tex., and has authorized co... pletion of the project. This action ... sulted from a finding that if the proj... were not completed, the possibility ... flood damage would be more serious th... prior to the beginning of the work. T... Barker Dam project was halted Feb. ... 1943, when WPB revoked preferen... ratings in line with its policy of halti... all construction work not directly as... ciated with the war program.

• • •

Labor relations forum o... A.W.W.A. program

A forum on labor relations proble... has been added to the program of t... American Water Works Associati... meeting to be held in Cleveland, Oh... June 15–18, according to Harry E. J... dan, secretary.

Leader of the discussion will be Jam... W. Irwin, assistant to the president ... the Monsanto Chemical Co. Assist... him will be Philip D. Niles, direct... of information, American Water Wo... & Electric Co., New York, who w... discuss adjustments arising from t... selective service requirements. A gro... of four waterworks managers who ha... had to deal with specific labor relati... problems will make up the panel ... discussors.



Long mucking machine lowered through small shaft

Pictured above is a mucking machine rigged for lowering into a new tunnel being built for connection of Chicago's present water tunnel system and the South District filtration plant. The machine is being lowered by a stiffleg derrick with chain blocks and cables rigged to derrick line to hold the mucking machine in vertical position to pass down the narrow shaft and to level it off in normal horizontal working position when it reaches the tunnel floor. The machine is about 30 ft. long, weighs 18 tons, and has a digging capacity of about 1/3 cu.yd.

The mucker is being lowered at the 75th St. construction shaft by workers of the construction division of the Bureau of Engineering of Chicago. In the foreground are John Dean, construction engineer; Mr. McKeefrey, machinery moving foreman; and A. G. Anderson, assistant engineer in charge of tunnel operations. Work is being done under supervision of W. W. DeBerard, city engineer of Chicago.

H. K. Ferguson Co. observes 25th anniversary

"Private industry's record in war production is a fair indication of the capability of business and industry to solve postwar problems for themselves and for the nation," Harold K. Ferguson, president of the H. K. Ferguson Co., industrial engineers and builders of Cleveland and New York, said recently in a message commemorating the 25th anniversary of the founding of this company.

The Ferguson Company was one of the first organizations in the United States to offer a complete industrial service, consisting of designing, building and equipping plants and factories ready for operation by their owners.

A recent achievement of the company was designing and erecting buildings for a large synthetic rubber plant in three and a half months (*ENR*, Apr. 8, p. 465). The plant produced rubber less than five months after it entered the design stage, and Mr. Ferguson termed this one of the fastest jobs in the 25-year history of his company. The Ferguson company has been awarded the Army-Navy "E" for its part in designing and building the Rocky Mountain Arsenal, a large plant for the Chemical Warfare Service at Denver. It was in operation several months ahead of schedule and at cost of several million dollars under the original estimates.

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Hartford toll bridge reduces indebtedness

The new Charter Oak toll bridge, which spans the Connecticut River between Hartford and East Hartford, has an excellent chance of completing its first biennium without a deficiency, reports Budget Director Robert H. Weir. Average daily receipts during March increased to $482 as compared with a daily take of $354 during February. Based on the continuation of the March daily rate, the net deficit at the end of this year would not exceed $57,000. It is estimated by Mr. Weir that an increase to $500 a day in toll receipts would wipe out the entire deficit this year. "It is not unlikely that this increased daily toll will be reached as weather improves, despite gasoline rationing and travel restrictions," said Mr. Weir.

New desert roads speeded by U.S. Army engineers

Previous speed records in road building are falling under new accomplishments here and abroad by combat units of the Army Corps of Engineers, reports to the War Department reveal. For example, in North Africa new techniques and equipment have resulted in desert roadways being laid out at the rate of four miles an hour—even higher speeds are in prospect.

The African desert highways, of course, are not the multiple-lane, smooth-surfaced roads that network the United States, but they are passable routes that allow supply trucks to move forward with advancing troops.

Specially organized pioneer road teams make the speedy construction possible. A powerful six-wheel drive truck carrying a tractor with a bulldozer runs ahead to attack difficult crossing points such as steep-banked stream crossings. It is followed by "V" drags, pulled either by tractors or tanks at a rate of 12 miles an hour. These clear the roadway of debris and do some grading. A high speed patrol-grader finishes the job.

Glass block gatehouse saves critical materials

Non-transparent, light-diffusing glass blocks form the lower halves and corners of the walls of this gatehouse which guards the entrance to a Midwestern manufacturing plant. Inserted panels of clear blocks in the upper portions give the watchman clear vision in every direction. Inside, electric lights and a telephone serve as a control station for guard activities 24 hours a day. A small electric heater has been sufficient to keep the guards warm and comfortable in their glass house during the coldest days of the past winter, due to the high insulating capacity of the glass walls.

Price ceiling increased on Douglas fir boards

Price ceilings were raised April 16 on four grades of Douglas fir boards to compensate sawmills for higher costs incurred in diverting their production of timbers and dimension lumber to boards. WPB directed mills to increase their normal production of boards to meet military needs, and the price increase authorized by the OPA April 16, applies only to producers operating in compliance with the WPB directive.

MPR-26, Amendment 14, which authorized the increased price, ordered all operators to cut into boards all logs or parts of logs ordinarily used for production of dimension or timbers of No. 1 grade or lower. The regulation allowed an increase of $3.50 M b.ft. in the three upper grades of boards. On No. 3 common, the ceiling was raised $1.50 per M b.ft. over the previously existing price.

Although ceilings were raised, actual costs are expected to be lower. OPA stated in its order that shortages of boards necessitated purchasing of logs by buyers, who then reshipped them to distribution yards to be reprocessed into boards, with the result that the total costs were much higher than the newly established ceilings.

JOBS OF THE WEEK

DIVERSION DAM, Texas and Oklahoma
W. C. Shepherd, Atlanta, Ga., will build diversion dams and new chann Grayson County, on Washita River, as protection for Cumberland oil fields, Engineers, Denison, Tex. Project will cost $4,848,227.

HOSPITAL, Washington
U. S. Engineers, Seattle, awarded contract for buildings, Spokane Count Clyde M. Ludberg Co., Spokane. Estimated cost, $1,000,000-$3,000,000.

APARTMENTS, West Springfield, Mass.
West Springfield Gardens, Inc., Springfield, will construct 27 two-story apart buildings. Estimated cost is $1,250,000. Henry J. Tessier, Springfield, is arch

HOUSING, New York
Silberblatt & Lasker, New York, N. Y., has been awarded contract for a ho project by Elmira Housing Authority, Elmira, N. Y. Estimated cost of constru is $1,149,100.

BUILDINGS, New Jersey
Andrew Christensen & Sons, Elizabeth, N. J., has been awarded contract build Middlesex Co., by U. S. Engineers, New York, N. Y. Estimated cost is $1,000 $5,000,000. Frank Grad & Sons, architect, Newark, N. J.

IMPROVEMENTS, Texas
U. S. Engineers San Antonio, Tex., awarded contract for roads, storm dr grading, at Army Air Forces installation, Bexar County, to R. W. Briggs and and M. B. Killian, San Antonio. Cost to exceed $1,000,000.

BRIDGES, Outside United States
Public Roads Administration, Washington, D. C., awarded contract for bridge Bates & Rogers Construction Corp., Chicago, Ill.

EXCAVATING, GRADING, etc. Nebraska
U. S. Engineers, Omaha, Neb., have awarded contract for excavating, grad surfacing in Dodge County to Inland Construction Co., Omaha, Neb. Estim cost is $500,000-$1,000,000.

AIRPORT, Richmond, Ind.
City of Richmond, awarded contract for airport, to Ryan Construction C Evansville, Ind., to cost $698,688. CAA project.

HOUSING, Ohio
W. B. Gibson Co., Warren, O., lowest bidder for housing project when Pu Housing Authority, Cleveland, opened bids on masonry $510,230; frame $460,7 Edward G. Conrad, Cleveland, O., is the architect.

HOUSING, Michigan
Public Housing Authority, Cleveland, O., awarded contract for housing, to Ow Ames Kimball Co., Grand Rapids, Mich., for $1,455,000. Skidmore, Owings Merrill Co., Chicago, Ill., are architects.

HOUSING, California
Housing Authority of City and County of San Francisco received lowest bid f dwellings, administration building and cafeteria, from Standard Building Co., S Francisco, at a cost of $1,058,685.

BUILDING, California
U. S. Engineers, Sacramento, Calif., awarded contract for building to MacDonald Kahn, Inc., San Francisco, Calif. Cost to exceed $1,000,000.

GASOLINE ABSORPTION PLANT, Santa Maria, Calif.
Union Oil Co., Los Angeles, Calif., awarded contract for a gasoline absorption pla to handle liquid asphalt gas to The Fluor Corp., East Los Angeles. Cost to exce $500,000.

FACILITIES, California
Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded contract f various facilities in 11th Naval District to Hodges & Karn, Los Angeles, Cal Estimated cost is $1,886,340.

Note—Additional bidding and contract news on many projects large and small appear in the Construc News section beginning on page 177.

Tension over labor-freeze order eased by work stabilization agreements

Workers may now transfer from one essential industry to another if certificate of availability can be obtained from employer.

The War Manpower Commission's "labor-freeze" order of last month (*ENR*, April 22, p. 51), which flatly forbad workers in essential industries to transfer to other jobs at higher pay, unless they were located in areas which have labor stabilization agreements, has been modified and made more workable. This has been done by bringing the entire country under labor stabilization agreements. Early this week nine of the twelve WMC regions had established temporary regional stabilization agreements, and by the end of the week the other three regions will have done the same.

The regional agreements vary in detail, but their general effect is this: A worker in an essential industry who wishes to transfer to another job in an essential industry must obtain from his employer a certificate of availability. If the employer will not grant it, the worker may appeal to the nearest office of the U. S. Employment Service, which will grant the certificate if he can show, at a hearing before a labor-management group, that he has been discharged, has been laid off for seven or more days, or is not working at his highest skill. These conditions were laid out in the WMC job-freeze order. In addition, the regional agreements provide for issuance of a certificate in "hardship" cases, which might include cases where the workers present pay is substantially below prevailing levels. Cases of this character were specifically ruled out by the job-freeze order.

These rules apply whether or not the transfer sought is to a higher paying job.

As to employers, they are forbidden under both the order and the regional agreements to hire anyone who, during the last thirty days, has worked in an essential industry, unless he can present a certificate of availability.

As before, there are no restrictions on transfers among non-essential jobs, except in those areas where local stabilization agreements already impose restrictions on such transfers.

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Young Chinese engineers study American methods

Thirty-two Chinese engineers in their twenties and early thirties, who hope some day to help rebuild industrial China, have arrived in the United States and are studying American engineering techniques, according to announcement made by the Board of Economic Warfare. Eight of the group have taken training positions with the Tennessee Valley Authority and the rest are with American industrial firms. Positions have been found for three others who are still in China or on their way to this country.

Under a program developed jointly by the BEW and the National Resources Commission of China, the young engineers will work here two years in fields which in most cases they selected as their major interest. The training program is being sponsored by the Division of Cultural Relations of the Department of State. Since the industries to which they have been assigned here are engaged in war work, the young men are first accredited by the United States Army and are paid by the National Resources Commission of China.

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Key West highway will be completed by end of year

Scheduled for completion by the last of this year, an 82-mi. stretch of road including the approaches from Key West and Homestead, Fla., is being reconstructed by the Florida State Road Department in line with recommendations of the Army and Navy, according to Thomas A. Johnson, chairman of the department.

Following the lines of an old abandoned railroad, the new $3,400,000 highway will shorten the distance from the mainland to Key West by 17 miles. Built with a subbase of native rock and finished with asphalt, this section of road contains 22 concrete bridges. An unusual feature of the project is the flight strip to be constructed midway along the new highway for emergency use by army planes.

Since January 1941 the Florida State Road Department has constructed, or has under contract to construct, highways valued at more than $17,000,000, strictly to aid the war effort. An additional $3,000,000 has been appropriated for construction as soon as rights-of-way are secured and plans and specifications prepared.

Master development planning or advance outlining of work until 1953 is now being done by the Florida highway department, covering an estimated $154,000,000 which will be needed for rebuilding old roads and constructing new highways.

Press Association, Inc.

Army Engineers Pave the Way

This picture shows the difficult terrain with which our troops have to contend on the Tunisian front. Repair crews of the Engineer Corps are shown as they fill holes in the road to accommodate the heavy truck and tank traffic during the advance of the American armored forces in the El Guettar valley. This is typical of the engineers' important work on all fronts.

"In the postwar period industrial financing of university research in engineering must supplement the present system of private endowment," says Prof. James K. Finch of Columbia University.

Wood Preservers discuss use of timber for war

Continued exertion of every effort to provide constantly better timber products and to fit them into places that release other materials needed for the war, was pledged by the American Wood Preservers' Association at its 39th annual meeting in Chicago on April 27.

In realization of the responsibility of the timber industry to preserve this country's supply of wood and to extend the scope of its usefulness, the session was devoted largely to improving present standards of procedure for treating timber, diversified uses of wood, painting and fire-retarding treatment of timber.

Many new and expanded uses have been found for treated timber in the past year, both as a substitute and as recognized permanent construction, said the association's president, W. P. Conyers, Jr., vice president, Taylor-Colquitt Co., Spartanburg, S. C. "However," continued Mr. Conyers, "we must individually and jointly be more persistent and imaginative in research, more diligent in improving production technique, and more aggressive in merchandising if we are to create for ourselves an improved position in the postwar world."

Increased use of timber

Despite curtailed manpower, scarcity of materials for plant maintenance and overtaxed transportation, the wood-preserving industry has contributed in full measure to the national war effort throughout the entire period since hostilities became imminent, reported Walter Buehler, sales manager, Barrett Division, Allied Chemical & Dye Corp., New York. Restrictions on material procurement have forced tremendous retrenchments in state, municipal and private projects, said Mr. Buehler, even to the extent of delaying for long periods the building of structures actually vital to the war program, such as bridges and culverts on access roads. Material shortages, particularly steel, have forced a real study of alternate materials, and as a result there is a growing recognition and appreciation of the merits of treated timber for a wide range of structural uses, he said.

Freezing of stress grades of timber last year for war industries placed a premium on designs that utilize small sized materials of common and low grades for many structures without sacrifice of structural strength, reported Mr. Buehler. As part of this program the timber industry developed a composite concrete slab and timber construction which has been widely accepted for waterfront construction.

Construction of a number of Navy blimp hangars chiefly of wood was reported as an item of general interest to the 140 assembled members of the association. Each hangar required about 3,000,000 b.ft. which was given a fire-retardant treatment and in many cases also protection from decay (*ENR*, Apr. 22, p. 452).

R. H. Colley, engineer, Bell Telephone Laboratories, Inc., Muray Hill, N. J., was elected president of the association for the coming year.

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W. D. Wiggins retires, P.R.R. vice president

W. D. Wiggins, vice president in charge of engineering for the Pennsylvania R.R., retired April 30. Mr Wiggins had been in the service of the Pennsylvania for 48 years, beginning in 1895 as an assistant in the engineer corps at Logansport, Ind. Successively, and on different parts of what is now the Pennsylvania system, Mr. Wiggins was levelman, assistant engineer maintenance-of-way, engineer maintenance-of-way, division engineer, valuation engineer, chief engineer maintenance-of-way and assistant chief engineer. Since 1936 he has been chief engineer of the Pennsylvania system.

WASHINGTON HIGHLIGHTS

For completion of Shasta Dam and its power plants and transmission lines, the President has asked Congress to appropriate $16,400,000 for the coming fiscal year. This sum was not included in the regular budget because the amount was not known when the budget was prepared. A carryover of $14,000,000 will be on hand at the end of the present fiscal year, so that $30,400,000 will be available for expenditure on Shasta Dam when the new fiscal year opens.

Salvaged assemblies of steel shapes, trusses, built-up beams, etc., may be sold at the same 2.75c. per lb. price now established for re-usable steel shapes by Price Regulation 310 according to an amendment of that regulation this week. Complete structures—bridges, buildings, etc.—must still be priced by the method of the General Maximum Price Regulation—i.e., set a price and submit it to OPA for approval.

Government-financed war construction in March totalled $1,127,000,000, according to WPB estimates. This is a reduction from the February total of $1,170,000,000. Of the March total, $530,000,000 was for industrial construction, a drop of $32,000,000 from the February figure.

Hetch Hetchy power to produce aluminum

The war has brought to the city of San Francisco a purchaser for the power from the city's Hetch Hetchy plant that has been the subject of a long controversy between the city and the federal government. The purchaser is the Defense Plant Corp., which is building an aluminum reduction plant to be located within reasonable transmitting distance from the big hydro-electric system.

In 1913 Congress passed the Raker Act which, in authorizing San Francisco to go to the Yosemite National Park for water and power for the city, stipulated that the power developed in bringing water down from the mountains could not be sold to any corporation or individual for resale except to a municipality, a water district or an irrigation district. When the plants were completed in 1925, the city, lacking distribution facilities and being unwilling to duplicate those of the Pacific Gas & Electric Co. which was then serving the city, sold the power to that company for distribution within the city. In 1936 Secretary Ickes began action to upset that arrangement, and five years later the U. S. Supreme Court, by refusing a rehearing of an injunction obtained in a lower court, sustained the Secretary's views that sale to the P. G. & E. was in violation of the Raker Act. Since then the voters of the city have refused to vote the bonds necessary to build the transmission and distribution system needed before the city can go into the power business.

The city recently entered into a contract with the Defense Plant Corp. to supply power to the aluminum reduction plant, which is being built by the Aluminum Company of America. As power in excess of the capacity of the Hetch Hetchy system is required, the city has entered into a second contract with the P. G. & E. to purchase supplementary power to meet the needs of the new plant, which are reported to be very uniform about 100,000 kw. Operations of the city system and that of the P. G. & E. will be integrated to make the best use of the generating plants.

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Engineers wanted in W. Va

The Merit System Council of West Virginia announces that applications for positions in the State Health Department are now being received: Engineer, salary from $3720 to $4200; associate engineer, $3240 to $3720; principal sanitarian, $2640 to $3240; senior sanitarian, $2160 to $2640. Applicants need not be residents of West Virginia. The positions offer tenure of office and definite possibilities for promotion.

OBITUARY

...ry R. Beebe, 64, civil engineer ...d former commissioner of public ...ks of Utica, N. Y., died there April ... Mr. Beebe was graduated from ...sselaer Polytechnic Institute and ...er served the United States Geologi... Survey in New York and Michigan. ... erected mills and reinforced con...te buildings for manufacturers in ...ica, Rome and Buffalo, N. Y. as well ... hospitals and schools in other New ...rk State communities. Mr. Beebe ...d engineering work for the New York ...ntral R. R. and has been a member ... the Utica Water Commission.

...mes J. Sullivan, 75, civil and mining ...gineer and pioneer of mining develop...nt in northern Quebec and the ...nadian Northwest, died at Quebec on ...ril 25.

...arren Cox Lane, 87, who was super...ing engineer during the construction ... New York City's cable trolley line ...ng Broadway between Canal and ...ouston streets, died April 24.

...aniel Joseph MacDonald, 87, well ...own in Ontario and Quebec provinces ... a public works supervisor, died April ... at Trenton, Ont. Mr. MacDonald ...pervised the construction of the St. ...awrence river canals.

...on Piatt Keelor, 53, senior engineer ...th the United States district engineer ...rps at Kansas City, Mo., died there ...pril 30. A graduate in engineering ... Pennsylvania Military College, Ches..., Pa., and a captain in the first World ...ar, Mr. Keelor had been in the gov...mment engineering service for 24 years.

Byron E. Failing, for 16 years secretary of the Oswego River Watershed Corp., died at Oswego, N. Y., April 29. He formerly was with the New York state engineering department.

William Lee Bender, 79, former Stark County, Ohio, surveyor who served as an assistant to the state engineer on the reconstruction of the Ohio canal, died at Canton, Ohio, April 18.

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction in continental U. S. for the week totals $72,237,000. This volume, not including the construction by military combat engineers, American contracts outside the country, and shipbuilding, is 53 percent higher than in the preceding week, but is 83 percent below the record-breaking total of $434,955,000 reported for the corresponding 1942 week by *Engineering News-Record*.

Private work is 13 percent higher than a week ago, and public construction is up 58 percent as a result of the 68 percent gain in federal. Compared with the week last year, however, private is down 70 percent, public is off 84 percent, and federal declines 84 percent.

The current week's construction brings 1943 volume to $1,290,346,000, an average of $71,686,000 for each of the eighteen weeks of the year. On the weekly average basis, 1943 volume is 59 percent below the $3,326,739,000 for the nineteen-week 1942 period. Private construction, $132,960,000, is 48 percent lower, and public, $1,157,386,000, is down 60 percent when adjusted for the difference in the number of weeks reported.

In the classified construction groups, gains over last week are in sewerage, commercial and public buildings, earthwork and drainage, streets and roads, and unclassified construction. Earthwork and drainage is the only class of work to gain over a year ago.

New capital for construction purposes for the week totals $6,756,000, and is made up entirely of state and municipal bond sales. The week's total brings 1943 new financing to $486,035,000, a volume that compares with $6,777,852,000 for the opening nineteen weeks of the preceding year.

CONTRACTS

Continental U. S. Only

(Thousands of dollars)

	Week Ending May 7 1942	Apr. 29 1943	May 6 1943
Federal	$396,120	$37,189	$62,417
State & Municipal	21,644	5,306	4,612
Total public	$417,764	$42,495	$67,029
Total private	17,191	4,605	5,208
TOTAL	$434,955	$47,100	$72,237

Cumulative

1943 (18 weeks)	$3,326,739	
1942 (19 weeks)	$1,290,346	

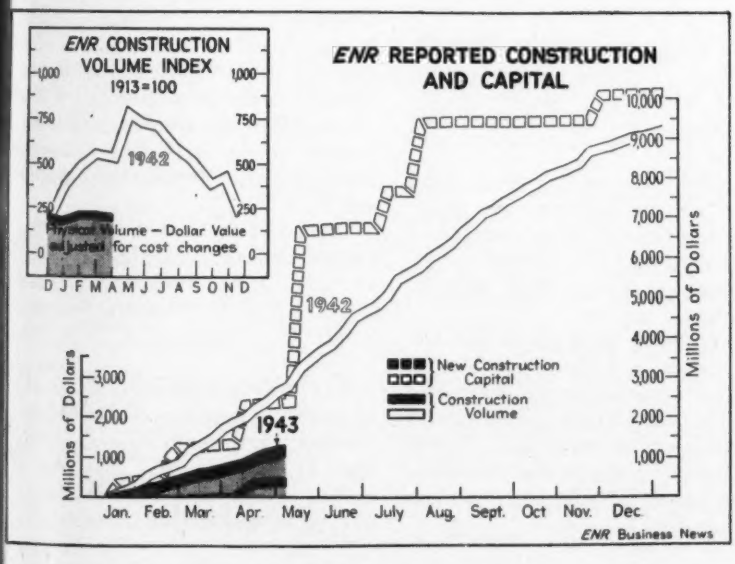
Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

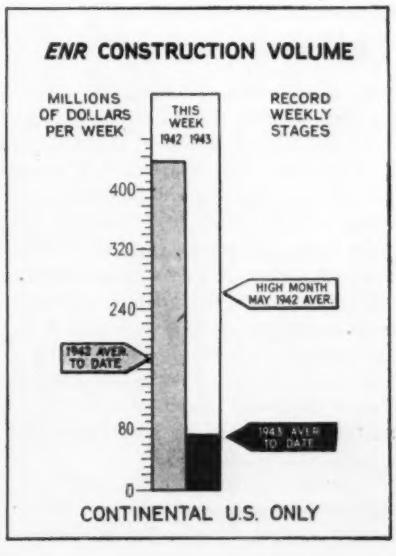
NEW PRODUCTIVE CAPITAL

	Cumulative 1942 19 weeks	1943 18 weeks
NON-FEDERAL	$238,897	$85,685
Corp. Securities	76,414	2,821
State & Mun.	131,120	71,231
R.F.C. loans	31,363	8,500
FPHA loans	.....	3,133
FEDERAL	$6,538,955	$400,350
TOTAL CAPITAL	$6,777,852	$486,035

ENR INDEX NUMBERS

		1913	1926
Index Base = 100			
Construction Cost	May '43	289.87	139.34
Building Cost	May '43	227.64	123.06
Volume	Apr. '43	225	99


ENR CONSTRUCTION VOLUME INDEX 1913=100
1942
Physical Volume — Dollar Value adjusted for cost changes
J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
1942
1943
New Construction Capital
Construction Volume
Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Eccentrically Loaded Columns

Sir: In the article "Beam Method of Design for Eccentrically Loaded Columns" (*ENR*, Mar. 11, 1943, p. 365), it is stated that this design was first presented by the author last May. However, the same method was presented by me in an article in *ENR*, July 26, 1928. I quote: "When the moment M is taken around the center of the tensile reinforcement, then the direct compression N has been transferred to and must be applied at this point. The resulting steel-area is therefor obtained by subtracting an area N/f_s."

In 1933 I found an article written by Mr. Arthur G. Hayden in the American Civil Engineers Handbook, which gave a very similar solution. Mr. Hayden regretted that he had not acknowledged the priority of my article and stated that he had not read it. Probably Professor Albert likewise was not aware of the prior publication.

C. L. CHRISTENSEN
Merritt, Chapman, Scott Corp., New York City, N. Y.

Sir: I am glad to acknowledge the fact, unknown to me before, that Mr. Christensen should be credited with priority on the beam method as far as his statements go, namely, "When the moment M is taken around the center of the tensile reinforcement, then the direct compression N has been transferred to and must be applied at this point. The resulting steel-area is therefore obtained by subtracting an area N/f_s."

At this time it might be of interest to state that the beam-method was published in the *Newark Engineering Notes* of May, 1938, under the name, "The 'Easy Formulas' in Reinforced Concrete Design." The magazine was mailed to the Portland Cement Association and the receipt of it was acknowledged. A method similar to the beam-method was given in the "Reinforced Concrete Design Handbook," published in 1940 by the Portland Cement Association.

ODD ALBERT
Assistant Professor, in Structural Engineering, Newark College of Engineering.

Sir: I have read with a great deal of interest the article entitled, "Beam-Method of Design for Eccentrically Loaded Columns." This certainly is a very ingenious method and I am sure that there will be a good many engineers who have sweat over this particular phase of design, who will wonder why they were not clever enough to think of it. I have used and taught the method outlined by Portland Cement Association for a number of years, but this method is much easier and simpler.

EDWARD A. MACLEAN
Professor of Civil Engineering Rose Polytechnic Institute, Terre Haute, Ind.

Sir: The author of the article on the "Beam Method of Design for Eccentrically Loaded Columns" (*ENR*, Mar. 11, 1943, p. 365), is to be commended for bringing this method to the attention of the concrete designers.

However, the idea of displacing the eccentric load to the center of gravity of the tensile steel, solving for the total bending moment thus established and taking into account the compression acting on the tensile reinforcement, is not new. The method is described in the "American Civil Engineers' Handbook" by Merriman & Wiggin (Fifth edition, page 1048). The same method is used in the "Reinforced Concrete Design Handbook" of the A.C.I., although there it is somewhat disguised under the mathematical treatment.

The following points are of importance to the designer who uses this method:

1. The allowable compression stress on the concrete has to be known. When said stress depends on the amount of reinforcement (or radius of gyration), trials may be necessary.

2. With the tendency to use tensile stresses as high as possible, the designer may find himself confronted with the fact that the required amount of tensile steel is nearly zero, or even negative. This means that the tensile stress has to be reduced, sometimes considerably.

3. A table of coefficients K, k, j and p for all possible combinations of f_c, n and f_s is necessary to the designer using this method. The table should cover values of f_s as low as 5,000 or even lower. Bending formulas using the above coefficients are somewhat simpler than those given in the article.

4. The examples given in the article show a member subjected to an eccentric load. The distance from the line of application of the load to the tensile steel is, therefore, known, and the total moment can be determined. When a member is subjected to an axial load and a moment, the location of said axial load depends on the distribution of the reinforcing steel. The load can be assumed to act at the center of the concrete section, but then the steel stress has to be chosen by trial so that the reinforcement is about equally divided between the tension and the compression faces of the member.

E. ZBINDEN
Montreal, Can.

Sir: The method suggested by Prof. Albert for designing eccentrically loaded columns is not new, but has been widely used for a very long time in one form or another by most designers in all countries.

For example, I quote the Reinforced Concrete Design Handbook of the American Concrete Institute, Detroit, Mich., where you may read in the introduction, page 8:

"There is no fundamental difference in the design of flexural members for simple bending and for those cases of combined bending and axial load, in which tension exists over a considerable part of the cross section. In the design equations for simple bending, M is replaced by NE, in which N is the axial load and E the distance from the resultant of tensile stresses to the equivalent eccentric load which may be substituted for M and N. . . ."

This is exactly the same idea as developed by Prof. Albert in his article.

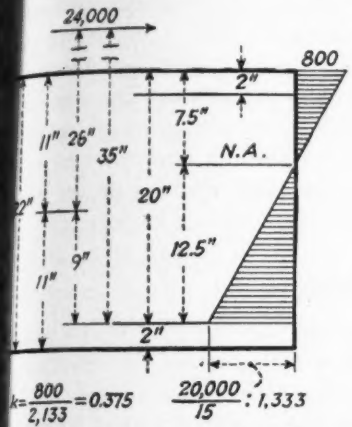
ROBERT V. HAUER
Structural Engineer, Detroit, Mich.

Sir: Prof. Odd Albert, in his article on structural members subject to both bending and compression (*ENR*, Mar. 11, 1943, p. 365) illustrates a method of computing the unit stresses in concrete and steel in a rectangular

ember. The bending moment is 24,000 in.-lb. (when taken about e centerline), the eccentric load is ,000 lb., and the eccentricity 26 in. finds that the unit stresses in the ncrete and steel are 800 and 20,000 i. when $n = 15$.

Let us reverse the process and de- rmine the amount of reinforcing, ing the same unit stresses.

The dimensions and set up are own in the accompanying drawing.



Design data for 12 x 22-in. concrete beam subjected to an eccentric load.

Since the amount of steel is undetermined we will fix the neutral plane so that when the unit stress in the concrete at the top is 800 psi., the unit stress in the tensile steel is 20,000 psi. This locates the neutral plane 7.5 in. below the top.

Moments about tensile steel =

$24{,}000 \times 35 = 840{,}000$ in.-lb.

Total compression in concrete =

$400 \times 7.5 \times 12 = 36{,}000$ lb.

Resisting moment about tensile steel =

$36{,}000 \times 17.5 = 630{,}000$ in.-lb.

In which is to be resisted by the compressive steel having a lever arm of 18 in.

Stress in compressive steel =

$$\frac{210{,}000}{18} = 11{,}667 \text{ lb.}$$

Unit stress in compressive steel =

$$\frac{20{,}000}{12.5} \times 5.5 = 8800 \text{ psi.}$$

Area compressive steel =

$$\frac{11{,}667}{8{,}800} = 1.33 \text{ sq. in.}$$

Total compressive stress in concrete and steel =

$36{,}000 + 11{,}667 = 47{,}667$ lb.

The total compression on the section must exceed the total tension by 24,000 lb. Hence the stress in the tensile steel is

$47{,}667 - 24{,}000 = 23{,}667$ lb.

Area of tensile steel =

$$\frac{23{,}667}{20{,}000} = 1{,}183 \text{ sq. in.}$$

These areas are the same as Professor Albert used in his problem. The total area in top and bottom is 2.513 sq.in.

So far so good. But now suppose the neutral plane be lowered to 8.7 in. from the top. If the allowed unit stress in the concrete is maintained at 800 psi. the steel unit stresses will be determined as follows:

$$\frac{800 \times 15}{8.7} = 1379$$

$1{,}379 \times 6.7 = 9{,}239$ psi in compressive steel

$1{,}379 \times 11.3 = 15{,}583$ psi in tensile steel

Then repeating the computation as above, we find 1.588 sq.in., as the area of tensile steel, 0.757 sq.in. as the area of compressive steel and 2.345 sq.in. as the total area.

By comparing the two cases we find the lower permissible unit stress in steel accompanied by the lesser total steel area required.

This rational conclusion is not a paradox. The *total* area of steel in the second solution is less, but the area of tensile steel alone is greater. Increase of tensile steel pulls the neutral plane down and thereby provides a greater resisting moment in the concrete. The difference in total area of steel in the two solutions is small; but in numerous designs it is large enough to have considerable significance.

The same theory is applicable to any rectangular beam having compressive steel, even when no direct compression is present. It is conclusive proof that a high permissible unit stress in steel does not always contribute to economy—a fact that is rarely displayed in reinforced concrete literature.

The writer has taught reinforced concrete theory for many years, and has never once permitted his students to use either formulas or the so-called transformed-section method. Both systems, in his opinion, are but substitutes for thought. Furthermore, solutions are much more simple, understandable and direct when worked from the fundamental statements of mechanics.

CHARLES A. ELLIS
Prof. of Structural Engineering
Purdue University,
Lafayette, Ind.

Postwar Local Road Needs

Sir: Your editorial "*The Time is Now*" (*ENR*, March 25, 1943, p. 415) is timely and well-written. One very important part of a practical postwar public works program is, however, overlooked. This is the secondary or local road. You state "If better state highways are needed, design them." But why use state highways as an example of necessary and desirable postwar construction? Why did you not say, "If better highways of all kinds, bridges on all roads and, a complete system of moderate cost railroad crossing protection on all roads are needed, design them now."?

In this locality, which is quite typical of most sections of the U. S., the aggregate amount of construction needed on secondary and local roads bulks far larger in construction expenditures and in economic transportation service return to the entire state and nation than many unneeded proposed reconstruction projects of state highways up to luxury bracket standards, exemplified by super-highways and such, which have actually been completed in detail and given priority and preference ratings for postwar work.

The actual "physical" needs of the secondary and local roads over the U. S. as a whole involve the expenditure of at least 10 to 15 billion dollars. At least 50 percent of the work can and should be done by competitive contract procedure, and at least 40 percent by really good local force-account procedure, free from the faults of relief program construction.

Definite detail plans should be prepared at once for such work. That a large number of moderate size projects, well distributed geographically, are more effective in all ways than the same total expenditure for a few spectacular projects of less certain economic service return must be evident.

In this locality the stronger, richer counties and towns have actually started to prepare such plans, but most areas are well described by the last sentence of your editorial: "There is danger, that planning talk and not planning action is what too many have in mind."

W. G. HANGER,
Rochester, N. Y.

[The expression "state highways" in the editorial in question was used in its broadest sense—EDITORS.]

EDITORIALS

VOLUME 130 NUMBER 18

May 6, 1943

Don't Bring it Back

CONSTRUCTION EQUIPMENT taken over by the War Department on many large contracts during the past year and a half is being prepared to be sent abroad or already has gone abroad in anticipation of the construction that must be done behind invasion forces. More equipment is being taken by construction battalions of the Navy and general service regiments of the Army. Thus is being repeated, on a larger scale, what occurred in the last war. But then, a large amount of serviceable equipment that was sent to our armies in France was brought back and turned over to the state highway departments. That mistake should not be repeated following this war. Equipment sent overseas should be disposed of abroad, even if it has to be given away. In the first place, clearing the storage yards in this country of most of the surplus construction equipment will make it possible for our manufacturers to start quickly on the production of new equipment of improved design; and that will, of course, aid employment. In the second place, disposal of American construction equipment in remote corners of the world will familiarize constructors in those countries with our equipment; thus will be built up a demand that should provide export markets at about the time that our equipment manufacturers have passed the peak of replacement demand in this country. There should be no round trip tickets for construction machines.

Help For Housing

THE MORALE OF WAR WORKERS would be improved and their efficiency increased by lowering the bars that now keep private builders from undertaking small-house construction and house remodeling in areas where there is a shortage of housing. The resulting increase in demand for critical materials would not be large, and a considerable amount of serviceable housing would be created quickly to help correct the almost intolerable conditions under which thousands of migrant workers and their families are now living. The government is putting up housing projects in cities where shipyards and other war industries have imported labor, but the need is far from being met in regions where activities a still expanding. People are living in tents, shac trailers and even garages or are crowded into exi ing houses under conditions that cannot but und mine their health. Many people in those cities wou build small houses or would remodel old ones make apartments if they could do it without gettin involved in a maze of government restrictions, l they will not undertake the work if they have to fi out sheets of forms and be passed from governme bureau to government bureau to get authority spend their own money to buy needed material The recent amendment to Title VI of the Nation Housing Act will help somewhat, but this too i volves a round-about procedure. The war effo will not be affected adversely by more easing restrictions on housebuilding, and the health an well-being of thousands of workers in war indus tries should be greatly improved thereby.

War and Sanitation

AMONG SOLDIERS who are wielding weapons othe than guns—and wielding them effectively—ar members of the Sanitary Corps of the Medica Department of the Army, many of whom have bee recruited from civilian sanitary engineering pur suits. How well they are doing their job under th direction of Col. William Hardenbergh, chief engi neer of the Army Surgeon-General's office, can b estimated from facts that are now becoming avail able.

In malaria control, for example, the Army sani tary engineers have played a significant role, bring ing the 1942 malaria rate for troops in the contin ental United States down to 0.65 per 1,000 pe year. This is the lowest rate the Army has ever had, and can be compared with the 2.3 rate for the last decade, and the 7.5 rate in 1917. Even in the malarial regions abroad, where many of our troops are now stationed, the rate is far below that in the armies of other nations. Water-borne dis eases are also being carefully guarded against. In Army cantonments the policy of the Sanitary Corps is to maintain a 0.4 ppm. chlorine residual through out the distribution system, thus affording a degree of protection beyond that required in most public water supplies where a 0.05 ppm. chlorine residual in water entering the distribution system is gener ally considered sufficient. And particular attention is being given to water supply in hotels taken over by the Army for quartering troops, to guard against hazards from cross-connections and inadvertent pol lution of the supply.

Both at home and in theatres-of-operation, this engineering branch of the Medical Department is

lping to solve environmental health and sanita-
n problems that are vital in safeguarding troops.
hile their exploits in combatting the forces of nature probably will not make war headlines, the Sanitary Corps nevertheless is making a significant contribution to the victory of the armed forces.

POSTWAR FACT AND FALLACY

TCH OF THE INDECISION that characterizes post-
r construction planning stems from fallacious
liefs concerning the magnitude and character of
e job to be done. Likewise, where real progress
being made, as in New York State and New York
y, it is a direct result of realistic appraisal of
se same factors. If the fact and fallacy respect-
g the essentials of a program for postwar con-
uction could be separated, it seems likely that
ogress could supersede procrastination every-
here.

For example, it is a fallacy to count on construc-
on jumping in the first postwar year more than it
d between 1940 and 1941, or between 1941 and
942, when conditions for advance were ideal;
e increments added in each of these periods were
ree billions of dollars of volume and on-the-site
bs for about 600,000 men. If, during the war,
n-war construction declines to the absolute mini-
um that will sustain the civilian economy, authori-
tively estimated to be 1.5 billion dollars, then
e first postwar year construction volume could
ach 4.5 billion dollars, and no more. It is well
think in terms of some such modest volume
ther than of the ten or fifteen billion dollar figure
at is heard so frequently. Such maximum activity
a good objective for four years after the war ends,
t not a first-year goal.

It is also a fallacy to think of public-works con-
uction either as the major part of this volume or
a means of curbing unemployment and increas-
g purchasing power. These social and economic
spects of public-works construction received so
uch emphasis during the depression that it is
metimes difficult to remember that they are arti-
cial, and that the real purpose of public works
, to quote the National Resources Planning Board,
"provide the maximum of public service for the
inimum outlay of labor, materials, equipment and
ublic funds." Only such public works as meet this
efinition are candidates for postwar consideration
ecause, as Willard Chevalier, formerly publisher
Engineering News-Record and now publisher of
usiness Week, reminded the U. S. Chamber of Commerce last week, to do more will increase an already too full reservoir of purchasing power that is dangerously inflationary. The majority of jobs he also pointed out, should be provided by industries making consumer goods to meet the long-deferred desires of a war-starved people. To help industry get ready to do this, much private construction will be necessary. It could readily be that the ratio of private to public construction will revert to the predepression value of 2 to 1. In any event, public works can be confined to those projects whose need is widely recognized.

All this should demonstrate to the construction planners that their job is not one of frightening magnitude, and that its character is not unfamiliar. What needs to be done now is no more than the normal everyday job of planning specific, needed projects that engineers and construction men have done time and again before. The only new element involves acceptance of the fact that the preliminaries—authorization of the project, land acquisition, appropriation of funds for detailed plans, actual preparation of plans and specifications, and perhaps authorization of bond issues for financing construction—must be carried out now, without any definite date in mind as to when actual construction will start. Much of this construction will be the responsibility of the cities and states. They can and should do the necessary preliminaries without help from the federal government.

Analyzed thus, postwar construction planning can be seen to require no new or unfamiliar concepts or techniques; in fact, it is "normal" to a degree that has not been achieved since pre-depression days. So far, however, because fallacies have overshadowed facts, construction planning has been characterized by a kind of foxhole philosophy, compounded of watchful waiting and a fear that the job was too big and complex to be tackled just yet. But wars are not won, nor can we get ready for peace, by lying in foxholes. If construction planners would accept this fact, preparations for postwar construction would go ahead almost automatically.

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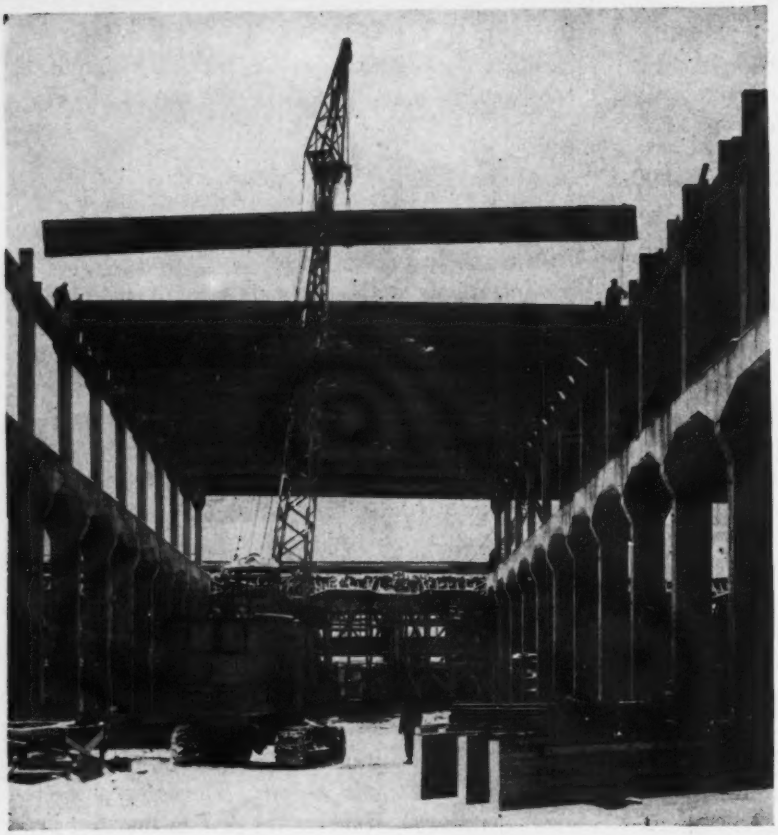


Fig. 1. Columns and crane girders of this heavy manufacturing building are of reinforced concrete and the roof beams are of laminated timber construction. These roof beams are of 60-ft. span, 7½-in. wide, and 38-in. deep.

Concrete and Timber Aid Fast War Plant Construction

***Contents in Brief** — To keep the use of critical materials to a minimum, a heavy manufacturing plant is being built of concrete and laminated timber. The substructure is almost entirely non-reinforced, and steel demands are very low for the total building. Roof utilizes 60-ft. span laminated timber beams of 7½ in. width and 38 in. depth. The materials selected lend themselves to immediate and rapid construction, assuring early completion.*

KNOWING THAT STRUCTURAL STEEL would be difficult to obtain and that detailing and fabrication work might be long delayed for a steel-frame structure, the U. S. Engineers decided to use a combination of concrete construction and laminated timber beams for a large plant to manufacture heavy war goods. To save reinforcing steel and to avoid long delays waiting for material deliveries plain concrete was used wherever possible. To further speed completion, a contract was awarded for the substructure, including the ground floor slab, before plans were complete for the remainder of the building. As a result, not only is the project to be completed on an extremely short schedule, but critical material requirements have been reduced to a minimum.

The one-story structure measures 300x800 ft. with its long dimension east and west. It consists of five 60-ft. wide, longitudinal bays with overhead cranes, plus a transverse bay of nearly equal width at each end. The building has concrete floors and walls. Concrete girders span 20 ft. between concrete columns to carry rails for the cranes, which vary in capacity from 5 to 20 tons. Along each row of columns and above the crane girders two lines of longitudinal laminated timber beams, known as carrying beams, support similarly constructed roof beams of 60-ft. span at 10-ft. centers.

The eastern two-thirds of the structure is without basement, but in this area a 17-ft. wide longitudinal pedestrian tunnel in the second bay from the north and a 10-ft. wide utility tunnel in the most southern bay are required. Transverse underfloor corridors and stairwells permit convenient pedestrian travel, without danger from the operations under way on the ground floor. Topography of the site made it advantageous to have a basement under the western one-third of the building. The column spacing in the basement, which provides space for offices, storage and toilets, is 20 ft. each way.

Soil conditions vary from a shale at the east end permitting a bearing of 6,000 lb. per sq.ft. to sandy soil at the west or basement end allowing a unit load of 4,000 lb. Thus, for foundations spread footings are permitted throughout. To provide sufficient bearing the column supports in the non-basement area are continuous longitudinal footings often 9 ft. wide at the base. In the same way, the walls of the tunnels and corridors are continuous massive non-reinforced designs frequently of 12-ft. 8-in. base width and decreasing to a few feet at the top. For the basement area individual 9x9-ft., non-reinforced, stepped footings are used.

All the substructure was built with a five-bag concrete delivered by pump through a 6-in. dia. pipe from a central 1-yd. mixing plant set up at the west end of the building. This plant location permitted the substructure concreting to start at the east end and progress westward, and

superstructure work to start at same end and follow closely.

The basement required three types floor construction. In office areas 8-in. non-reinforced slab was ed, in the toilets a 6-in. non-rein- ced slab covered by a 2-in. terrazo rfacing, and in heavy traffic areas 10-in. slab of plain concrete.

Bar trusses support forms

Above the basement columns the round floor, which was designed for 500-lb. live load, is a 4-way flat ab 15 in. thick and with 7-in. non- einforced drop panels. Construc- on of this slab was uncommon in at the forms consisted of expanded eel bar trusses on 18-in. centers upporting a ¾-in. plywood deck. By se of the trusses, which were of 0-ft. span and available from a earby job, shoring was kept to a inimum. Also the forms could be rected quickly and re-used many imes.

The continuous footings for the on-basement area were built in nonoliths about 18-ft. long and with -ft. openings between blocks. These reas were filled in after the concrete ad set and major shrinkage had oc- urred. Generally two pours were equired, one for the lower part of he foundation and the second, some- imes as high as 17 or 18 ft., to arry it to ground floor level. Ply- ood forms made up in 4x8-ft. pan- ls were used and they were stripped he next day. Curing was done by ddition of a sprayed transparent uring membrane.

With completion of the foundation alls and footings in the area with- ut basement, backfill was delivered y truck and compacted in place by he movement of the bulldozers used or leveling. Over the backfill an -in. non-reinforced concrete slab as built in 20-ft. strips with umped concrete. Dummy or keyed onstruction joints were provided very 20 ft. and the slab has thick- ned edges at truck entrances and at xpansion joints. Above the tunnels nd corridors one-way slabs with hicknesses of 12 in. and 18 in., re- pectively, were used. Over the round floor slab a 2¾-in. thickness f end-grain wood block floor will be dded after the building is closed in.

So rapid was the substructure onstruction that the superstructure ontractor started operations a few eeks after the foundations were be- gun. To be able to work on a completed floor slab is proving of great value to the superstructure contractor during periods of heavy rains.

The exterior walls, which are designed for 30-lb. wind load, measure 49 ft. 4 in. to the top of the parapet. For the first 9 ft. above the ground they are 12 in. thick and reinforced with ½-in. round bars on 12-in. centers each way. Above the 9-ft. level, they are 9-in. thick and similarly reinforced. The walls are made integral with the exterior columns, which measure 2 ft. 9¾ in. by 2 ft. at the base. In each bay there are three glass-block windows of one-block thickness. The windows are separated by a 4 ft. 6 in. height of wall and each measures 15 ft. 3 in. long by 5 ft. 10 in. high.

Expansion joints of 2-in. width and on 220-ft. centers are required in the exterior walls; the joints are filled with a mastic concrete matching the color of the walls. In addition, a vertical control joint is required at the center of each 20-ft. bay. These joints are created by nailing metal strips to the forms to produce a 1¼-in. deep groove in each face. Only alternate reinforcing bars are continuous through these joints.

The exterior walls are constructed

Fig. 2. Walls along the pedestrian tunnels in the non-basement area are free of steel, except for the dowels for the columns, which extends 1 ft. below floor level. The walls were built in 18-ft. long monoliths.

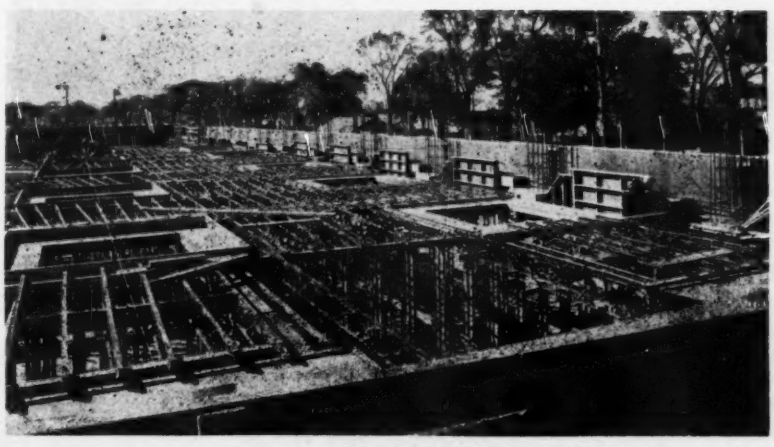


Fig. 3. In adding the reinforced-concrete floor slab over the basement area the formwork was greatly reduced by use of expanded steel-bar trusses to support a ¾-in. plywood deck. Forms are shown in place for the non-reinforced drop panels.

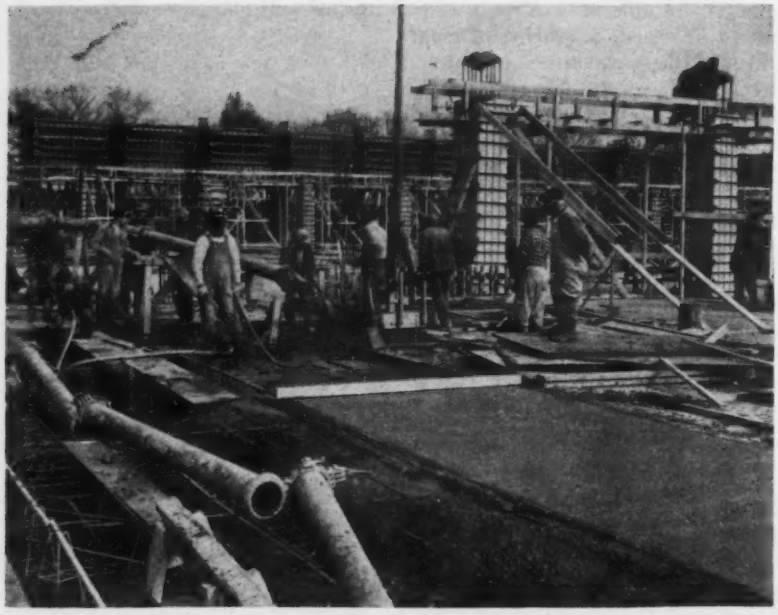


Fig. 4. Concrete for the ground floor, which was designed for a 500-lb. live load, was delivered by pump and vibrated in place. Slab shown under construction is above basement area and it has 4-way reinforcing; where the floor was placed on the ground an 8-in. non-reinforced slab was used.

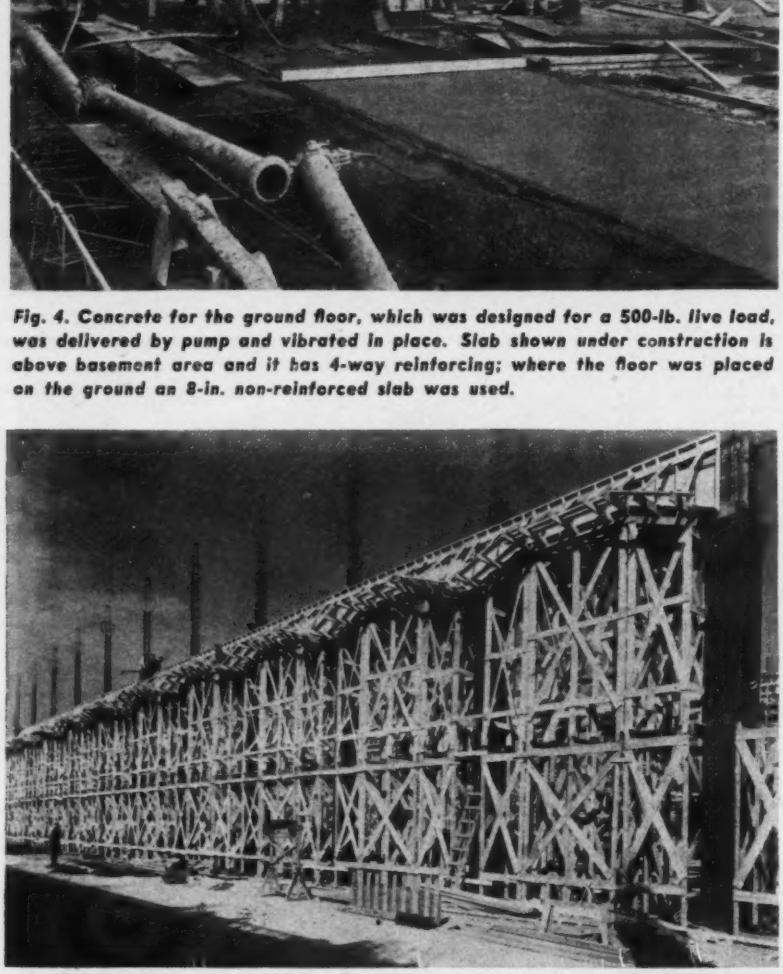


Fig. 5. Interior columns and attached crane girders of reinforced concrete, were constructed in four pours. Forms for the third pour or for the girders are shown in place. It should be noted that shoring for each 20-ft. bay is assembled in three sections.

in six lifts. The first lift is 9 ft. high or from the ground floor to the lowest sill; the second, 5 ft. 10 in. or to the top of the lower window; the third, 10 ft. 5 in. and from the spandrel beam to the top of second window; the fourth is of the same height and to the top of the third window; the fifth, 11 ft. high and to the top of columns; and the last lift is the 2-ft. 7-in. high parapet wall.

Exterior wall forms are designed for a maximum rate of rise of the concrete of 4 ft. per hour. The forms are 4-ft. wide by 8-ft. high panels of ¾-in. thick plywood backed up by 2x6-in. hemlock timbers around all edges, plus 2x4-in. vertical studs on 16-in. centers. All the panels are interchangeable. The ties through the wall are on 30-in. centers and so constructed that the ends of the ties screw out, but the center portion remain in place to prevent holes through the wall. The double wales, two 2x6-in. timbers, are bolted to the forms, as is all scaffolding. To tie the adjacent form panels together bolts are provided through 2x6's along the edges of the panels.

Concrete for the superstructure is manufactured by a stationary 1 cu. yd. paving mixer set up at the east end of the site. The concrete is delivered to the point desired in 1-cu. yd. buckets transported by truck. It is placed in the forms for several bays at one time by a crawler crane operating on the completed ground floor. A concrete of 1:2:4 mix is used and it is placed in 1-ft. lifts, hand spaded and vibrated in place.

The wall forms are left in place 36 to 48 hr. after the concrete is placed. Moistened burlap bags are kept on the exterior face of the wall for the 7-day curing period. On the inner face a thin transparent curing membrane is added; this method is not employed on the outside because its use on the foundation walls resulted in slight discoloring of the concrete. The form panels are dismantled by the crawler cranes used for erection of the forms. For short moves the forms are loaded on rubber-tired carts rolled about by hand, but for long moves they are transported ahead by truck. Because of the rush schedule, sufficient panels were fabricated to require use of each panel at only two places along the wall; the same panels, of course, are used for all vertical lifts at any one point.

To prevent freezing, covered frames are used inside and outside the walls to house the areas where glass blocks are being laid for the windows (Fig. 7). The frames are very light, built of 1x2-in. lumber with a 1x1-in. support lengthwise in the middle. The frames are approximately 6x16 ft. in size and are hinged together at the ends in strings of three. One end of three such strings are nailed to a 2x6-in. timber, which is then raised with block and tackle suspended from the roof. Adjacent panels are tacked together lightly to maintain alignment, and the ends are closed with tarpaulins. When the tops of the panels are leaned against the building wall, the space is entirely closed and can be heated with salamanders. The light muslin provided some ventilation and excellent light. About 80

.ft. of wall is protected at one time, hich allows quite a number of ricklayers to work.

Interior columns built in four pours

The interior columns are about) ft. high and each carries two lon- itudinal reinforced-concrete crane irders designed to accommodate ranes of 5- to 20-ton capacity. The olumns measure 3x3 ft. in the base- ent and 2x3 ft. above the ground oor. The steel reinforcing for the olumns in the basement area starts ft. below basement floor level and the non-basement area is carried ell below the ground floor. The col- mns and the crane girders are con- ructed in four pours. The first pour to 11 ft. above the floor; the second, l to 17 ft. 8 in. above the same level nd including the crane girder seats; he third, is for the crane girders; nd the fourth for the remaining olumns.

The column forms consist of ¾-in. lywood backed up by vertical 2x6's nd held in place by column clamps n 8-in. centers. The concrete is elivered as for the exterior walls. t is vibrated in place, and the forms re stripped the next day.

Shoring for support of the crane irders consists of 4x4-in. posts raced with 1x6-in. lumber. In the orizontal direction, the shoring is constructed in three sections for each 20-ft. bay. The largest framing is for the middle section of the girder or that of uniform cross section. At ither side is shoring for the haunched portions of the girder. The forms, which consist of ¾-in. plywood over 2x4-in. vertical studs on an 18-in. spacing, are supported by 2x8-in. timbers on 3-ft. centers and resting on the shoring just mentioned.

Formwork for the girders is left in place until the modulus of rupture of 6x6-in. test beams has a value of 450 psi. To remove the formwork the 2x8-in. timbers and the plywood panels first are taken down. Next, casters are added under each post of the shoring and the sections moved forward by hand to the next location. A transparent curing membrane is sprayed on the concrete to prevent too rapid drying out.

Erection of the roof framing follows closely behind construction of the walls and columns. The timber girders carrying the roof beams are of glued-laminated construction and they are delivered to the site ready for erection. They are fabricated of random lengths of 1x8-in. southern yellow pine and West Coast Douglas Fir. The members are designed for a maximum fiber stress of 1,800 psi. These girders, which are of 20-ft. span, are 7½ in. wide and 24 in. deep; the 60-ft. roof beams are of equal width but of 38-in. depth.

In fabricating the shorter beams no bolts or nails are required and glued scarf joints are employed in

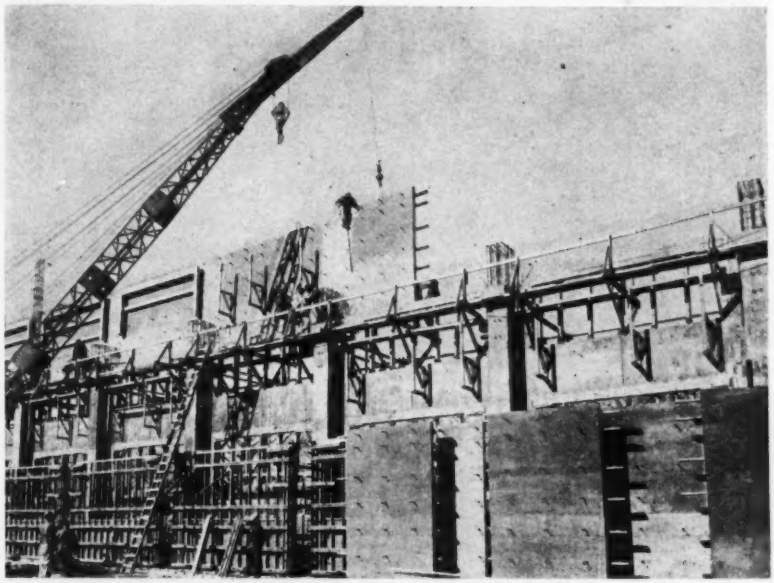


Fig. 6. Exterior walls—49-ft. high, 12-in. thick at the base, and 9-in. above the 9-ft. level — are constructed in six pours with 4x8-ft. form panels faced with ¾-in. plywood. Panels are handled by cranes, which also deliver concrete by means of 1-cu. yd. buckets.

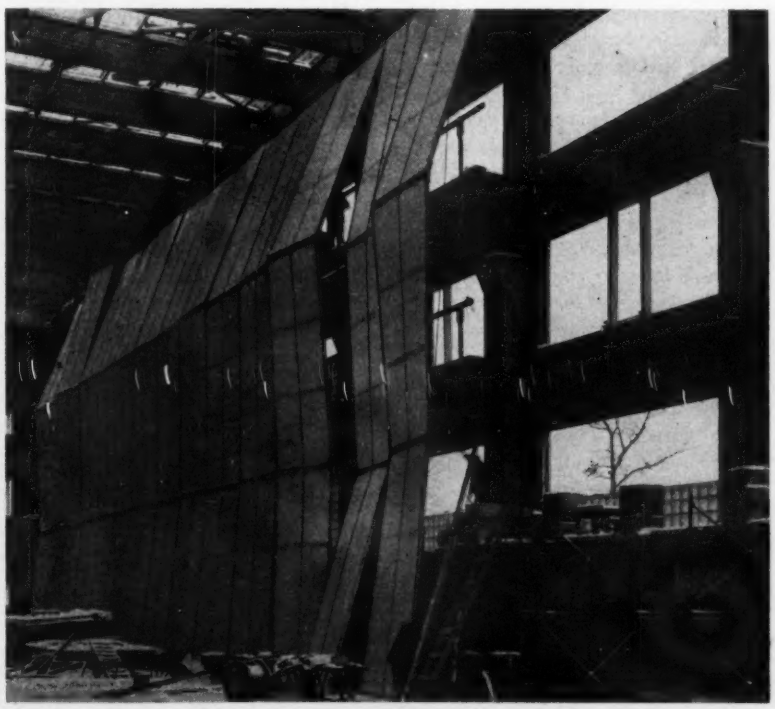


Fig. 7. To prevent damage from freezing in constructing glass-block windows, wood frames covered with muslin are used on both sides of exterior wall. After frames for about 80 ft. of wall were erected, tarpaulins were added at the extreme ends of the panels and salamanders installed in the enclosed space.

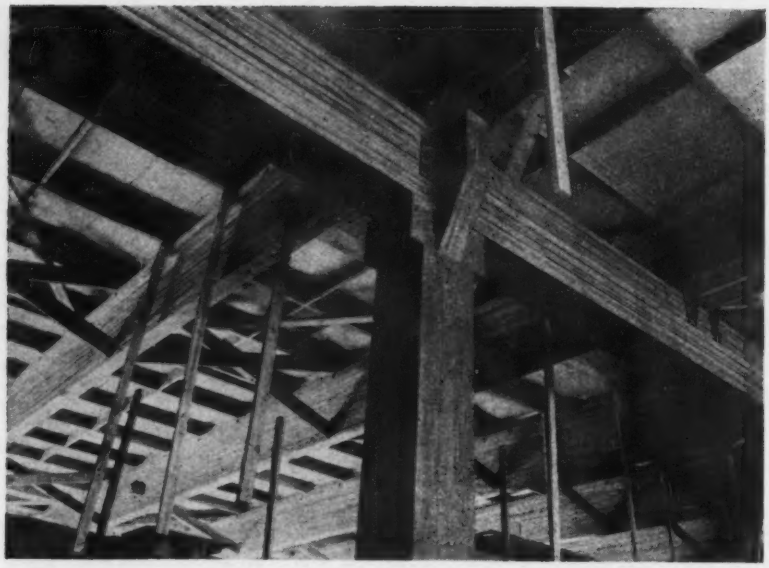


Fig. 8. Detail at top of reinforced-concrete column. Lower timber beams span 20 ft. and are 7½ in. thick and 24 in. deep; it is to be noted that two lines of beams are used side by side. Upper beams are 60 ft. long, of equal width and of 38-in. depth.

joining in the 1x8-in. material. A camber of 0.356 in. is built into these members, one-half of which is expected to disappear under dead load. Fabrication of the 60-ft. beams is similar, except that the camber is 3 in. Near the top on either side are added ledgers for the joists. Each ledger consists of four 1x4-in. pieces held in place by glue, ½-in. dia. bolts on 4-ft. centers and 40-d. spikes on a 1-ft. spacing.

Each row of longitudinal columns supports two lines of carrying beams. One beam of 15-in. width could, of course, be used, but this would require a special width of lumber, since headroom requirements prohibit a narrower but deeper beam. Erection of these beams is being done by a 1¼-yd. crawler crane with a 70-ft. boom plus a 10-ft. jib. The beams rest on steel bearing plates, a bearing 8 in. long and the width of the beam being provided at each end. The beams are bolted to the columns to increase continuity of the framework in the longitudinal direction.

The 60-ft. roof beams, at 10 ft. c. to c., also are erected by crane. These members are joined across the column by a 3x8-in. timber at top and bottom on both sides. The 3x8-in. timbers are bolted to the girders with split ring connectors; they also are bolted to the columns. The intermediate roof beams are held upright by two clip angles on each side of the carrying beams.

The roof is designed for a 35-lb. snow load and 3x8-in. joists on 4-ft. centers are used. Bracing consists of 2x8-in. staging for one bridge in the middle of each bay. The joists are covered by a 2-in. gypsum plank, a 4-ply, built-up roofing, and 4 lb. of gravel per sq.ft.

Down the middle of the longitudinal bays 16-ft. wide, wood-frame skylights varying in length from 90 to 100 ft. are provided. Skylight framing consists of 2x6-in. rafters, 3x6-in. purlins and 2x4-in. studs. Overlapping sheets of corrugated, obscure glass are employed.

Ventilation of building

Ventilation of the plant is by the wood-frame louvers in the side walls below the windows and by a 9-in. wide opening running the full length of all skylights. Heating will be by unit heaters hung from the roof beams, 48 units to be required for the 300x800-ft. area. Each unit will have a 460,000-B.t.u. hourly capacity to warm 6,350 cu.ft. of air per minute.

Power for the manufacturing area is supplied by 22 air-cooled transformers to reduce the current from 2,400 to 120-240 v. The transformers are supported on column brackets and the current is carried down the columns by exposed armored cables. Lighting is by 1,500-w. incandescent units spaced on 20-ft. centers each way and supported 37 ft. above floor level. Throughout the office section fluorescent lighting is used.

The building is to cost $2,500,000. The project is supervised by the Rock Island, Ill., District, U. S. Engineers, with Col. W. J. Matteson, district engineer; F. A. Hansen, resident engineer, and George L. Miller, assistant resident engineer. C. A. Leonard, head of the planning section, is supervising design.

The substructure was built by the T. S. Willis Construction Co., Janesville, Wis., with E. J. Cullem, superintendent, and the Priester Construction Co., Davenport, Iowa; George Jamsen, superintendent, is building the superstructure. Harza Engineering Co., Chicago, Ill., is consultant on the foundations. Rilco Laminated Products Co., St. Paul, Minn., is supplying the timber beams.

Asbestos Shingle Coating Protects Wood Piling

Studies made in the San Francisco Bay area on means of protecting wood piles from borer attacks (while creosote is a critical material) included experiments made with an asphaltic preparation covered with a layer of asbestos shingles. The asphalt was mopped on hot, a small area at a time, and before it had cooled the area was covered with asbestos shingles much as in applying shingles on a roof, lapping them about two-thirds the dimension both ways and tacking them down with closely spaced 2-in. copper nails having large heads.

Three such piles were prepared and driven in a location where the coated zone remained above ground after the piles were driven, thus affording opportunity to observe the coating under action of the hammer. After having been driven to practical refusal, a 30-min. pounding with a No. 1 Vulcan hammer produced not the slightest indication of nails or shingles loosening.

Conclusions were that the light weight of the coating and hence the lack of inertia, as well as the fact that the coating was firmly fastened to the wood, accounted for the lack of any tendency in the coating to separate from the pile.

This experiment was suggested by the Ben C. Gerwick Co., Inc., and was carried out for information of the U. S. Engineer Department.

Old Concrete Slab Salvaged for New Road

C. A. Rothrock,
Assistant State Construction Engineer
State Road Commission of West Virginia, Charleston, W. Va.

***Contents in Brief** — In changing a two-lane road into a dual-lane divided highway a new 6-in., non-reinforced slab was placed directly on the old concrete after the surface of this slab had been treated to eliminate bond between the old and new construction. Because of the increased width and different centerline with the new work, special construction was required beyond the old slab. In these areas an 8-in. non-reinforced pavement was built on a 4-in. compacted fill of blast furnace slag. To install forms on the old slab required some uncommon construction.*

AN OLD CONCRETE PAVEMENT on U. S. Route 60 at South Charleston, W. Va., has been successfully salvaged by resurfacing the road with a non-reinforced slab free of dowels and tie bars. The work, totaling 1.3 mi., is part of a 15-mi. project to eliminate a bottleneck to war plants in that area and included construction of an additional traffic lane each way and a grade separation over an industrial track of the Chesapeake & Ohio R. R.

The old construction consisted of two 10-ft. lanes built in 1934. In the studies for the new four-lane, divided highway the old pavement was found to be in good shape. However, its 20-ft. width was not well adapted to fit the multiple-lane, divided-section desired, since elevation of the slab was too low for good surface drainage. Thus, to obtain the higher elevation desired, it was decided to construct a new pavement of 6-in. minimum thickness directly upon the old concrete wherever the old and new construction overlapped. Where the new road was wider than the old slab, special construction was required to provide uniform support for the full width of the new concrete. Thus three general cross sections were adopted.

The first, which is designated Type A construction in Fig. 2, was 1,500 ft. long and consisted of four 11-ft. lanes, two on each side of a 3-ft. dividing strip. An integral curb on the outside and a separate white concrete curb along the median strip was required. The centerline of this section was located 12 in. to the south of the center joint of the old pavement. Thus, the new inside lane on the south side had a bearing of 7 ft. 6 in. on the old pavement and an overhang of 3 ft. 6 in. The inside lane to the north of the center island had a bearing of 9 ft. 6 in. on the north lane of the old pavement and an overhang of 1 ft. 6 in.

On this section, the thickness of the new pavement bearing on the old concrete is 6 in. minimum, and the overhang for each of the two inside lanes is 9 in. of concrete on a 3-in. slag base. An expansion joint filler ½ in. thick and 4 in. wide was placed

Fig. 1. Rapid and economical construction of this dual-lane highway, which relieves a bottleneck at South Charleston, was made possible by building a 6-in. non-reinforced slab on the old pavement.

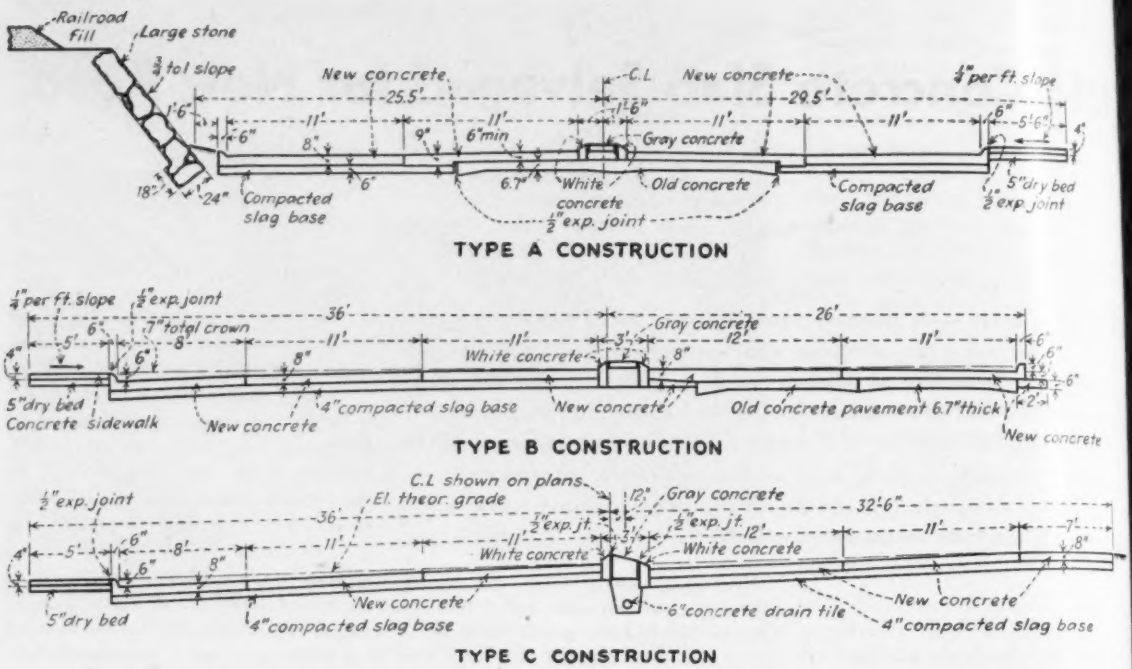


Fig. 2. Although three general types of construction were required for the greater length of the project, the greater part of the old pavement was salvaged by use of one of the two upper designs.

along the outside of the old pavement to eliminate bond between the old and new concrete. The two outside lanes of the section are of 8-in. uniform thickness, placed on a 4-in. slag subbase. The subbase was built of blast furnace slag graded from 1 to 2½ in. in size, well rolled and filled with slag screenings to form a dense impervious course.

Type B construction

The second general section, which is shown as Type B construction in Fig. 2, was over 3,500 ft. long. It consisted of two 11-ft. traffic lanes and an outside parking lane 8 ft. wide on the south side of the 3-ft. median strip, and a 12-ft. wide inner lane and a 11-ft. outer lane to the north. An integral curb was used on the two outside lanes, and a separate white concrete curb along the dividing strip, as with the first section.

The centerline of the dividing strip of this section lay sufficiently to the south of the center joint of the old pavement that the joint between the 12-ft. and 11-ft. lane of the north roadway was about 12 in. to the south of the old center joint. Thus, the north inside lane had a 9-ft. bearing on the old pavement and a 3-ft. overhang and the north outside lane an 11-ft. bearing and a 6-in. overhang, which is the width of the integral curb. Under the left overhang, a concrete bearing, instead of a crushed blast furnace slag subbase, was used as a support for the new pavement. Depth of this concrete was variable or such that its thickness, plus the depth of the new pavement required for the planned crown, equaled 12 in. The thickness of the new construction was as much as 10 in. along the south edge of the old pavement, due to differences in crown slopes of the two slabs and the 6-in. minimum permissible thickness for the new construction.

An additional concrete bearing strip 6 in. deep and 2 ft. wide was built along the north edge of the old pavement. The outside edge of this strip extended about 18 in. beyond the vertical face of the new integral curb on that side. The three lanes south of the dividing strip were made 8 in. thick and built on a 4-in. compacted crushed slag subbase.

Type C construction

Designated Type C construction in Fig. 2, the third typical section was used on a horizontal curve where the required superelevation made resurfacing of the old pavement impractical. At this point the lane widths are the same as on the second section above described, and an 8-in. uniform thickness of concrete was constructed on a 4-in. compacted slag subbase. On all three sections the concrete dividing strip had appropriate openings for necessary cross-overs and intersections. The opening between the white center curbs was paved with gray concrete to provide a safety walk.

Asphalt coating separates slabs

At all places where the resurfacing was placed directly upon the old concrete, the old surface was cleaned and coated with asphalt of the 85 to 100 penetration at the rate of 0.1 to 0.15 gal. per sq. yd. The asphalt was immediately covered with about 10 lb. of blast furnace slag screenings per sq.yd.; the thickness of the membrane coating that resulted was approximately ⅛ in. This coating is expected to provide a positive separation, without bond, between the old and new pavements and to provide for movement occasioned by temperature differences between the two slabs.

No steel was used in the new pavement as the subgrade was considered sufficient, either by reason of the slag subbase or by the old pavement, to resist compression and settlement. No load transfer devices, tie bars or reinforcing were employed.

Expansion joints were required at intervals of 120 ft. and in constructing these joints no consideration was

ven to the spacing of those in the pavement, since it was assumed the bituminous membrane separating the two slabs would prevent transfer of stress. The expansion joints were placed against bulkheads held in position by clamps, as shown in an accompanying photograph. The bulkheads were also braced by bags of sand and other weights. Intermediate joints of the dummy type were placed at 20-ft. intervals between the expansion joints; based upon past experience, this spacing was considered sufficient by the highway commission engineers to prevent further cracking.

Setting forms on old slab

Considerable ingenuity in setting forms was necessary for the new construction, since many of the forms had to be fastened on the old slab and in some cases on the new concrete. Only one lane was constructed at a time and where the first lane built had one edge on the old pavement, holes had to be drilled for all the line and form stakes. The holes were made oversize for the ¾-in. pins, and filled with sand, which gave a good firm "hold" to the stakes. Final lining proceeded as usual, and the exact grade elevation at the top of the forms was obtained by using wooden blocks and wedges of various sizes under the steel forms. The resulting forms were excellent from the standpoint of line and grade.

Where the forms were to be placed upon a new concrete subbase, the forms were laid on the freshly floated concrete and immediately set to line and joined. Next, the stakes were driven through the holes in the forms and into the green concrete. After the pins were twisted several times to make over-size holes they were withdrawn. When the concrete subbase had hardened and it was time to add the top slab, the holes were filled with sand, the stakes driven, and the forms lined and graded as usual.

Curb inlet saves steel

To reduce the use of steel a special curb inlet was adopted. This construction required no steel grating, as a reinforced-concrete slab cover was used. The cover was 4x3 ft. in plan and 3½ in. thick and required only 27 lb. of steel. It was recessed into the walk and curb, flush with the top of the latter; it may be readily removed for cleaning the inlet box.

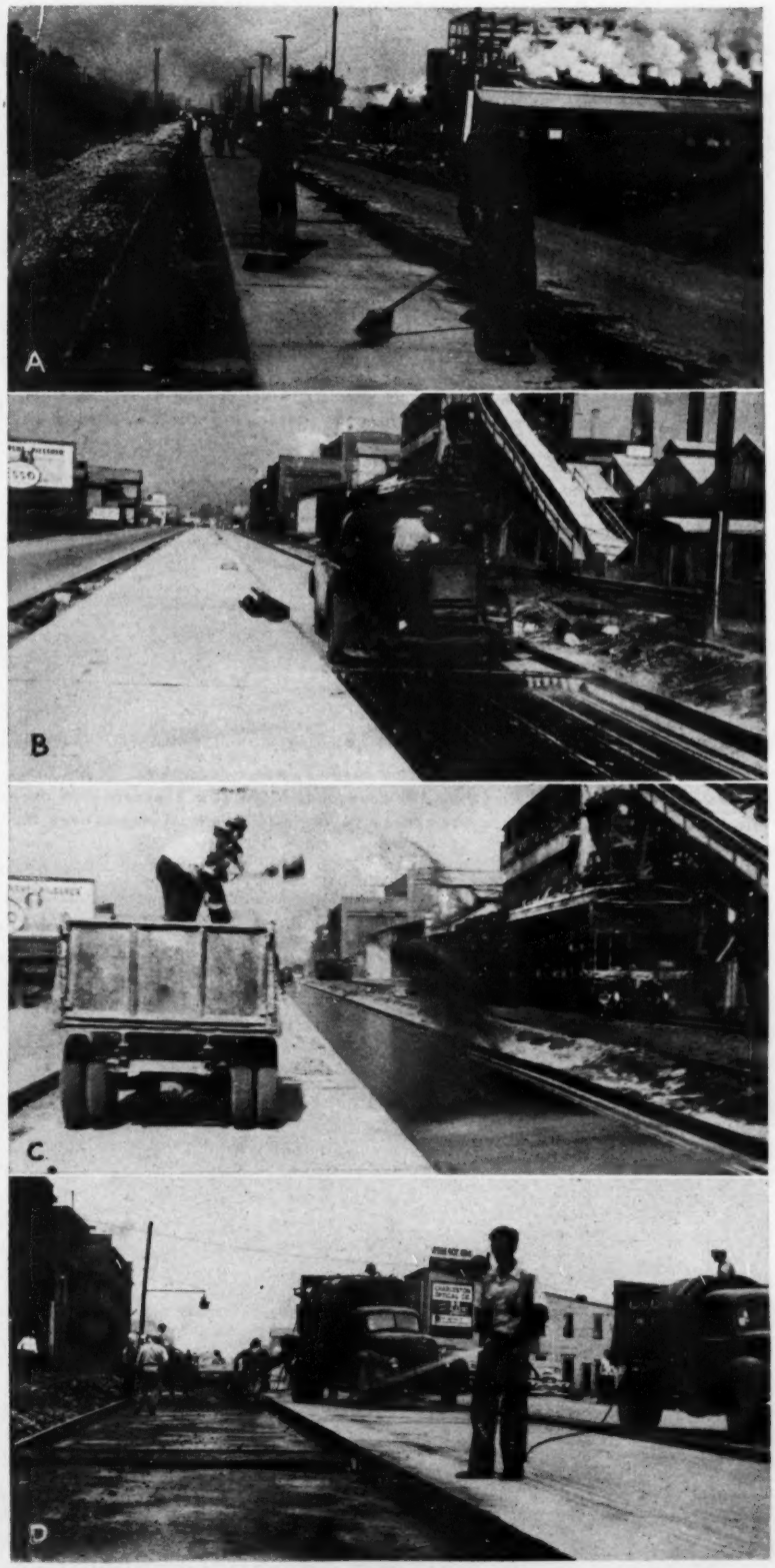
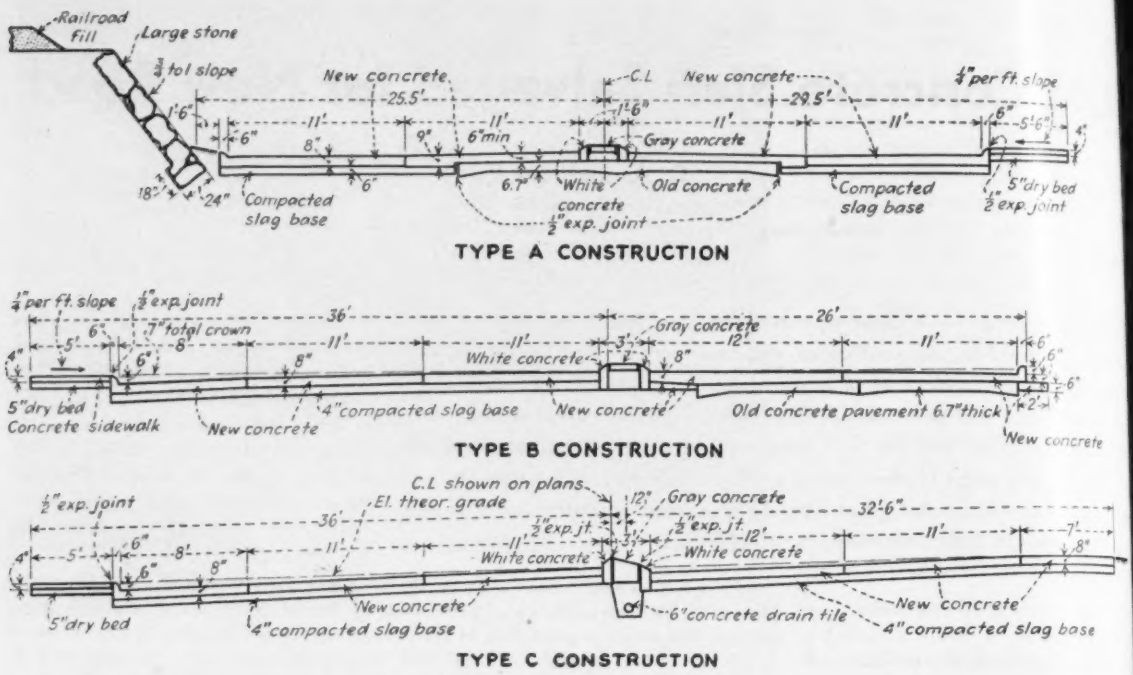


Fig. 3. Before the new concrete was added over old slab, the old pavement was cleaned (Photo A) and the concrete covered with a thin bituminous coating (Photo B) and slag screenings (Photo C), which were next moistened with water (Photo D). How clamps held in place the wood bulkheads employed in construction of the expansion joints also is shown by the lower photo.



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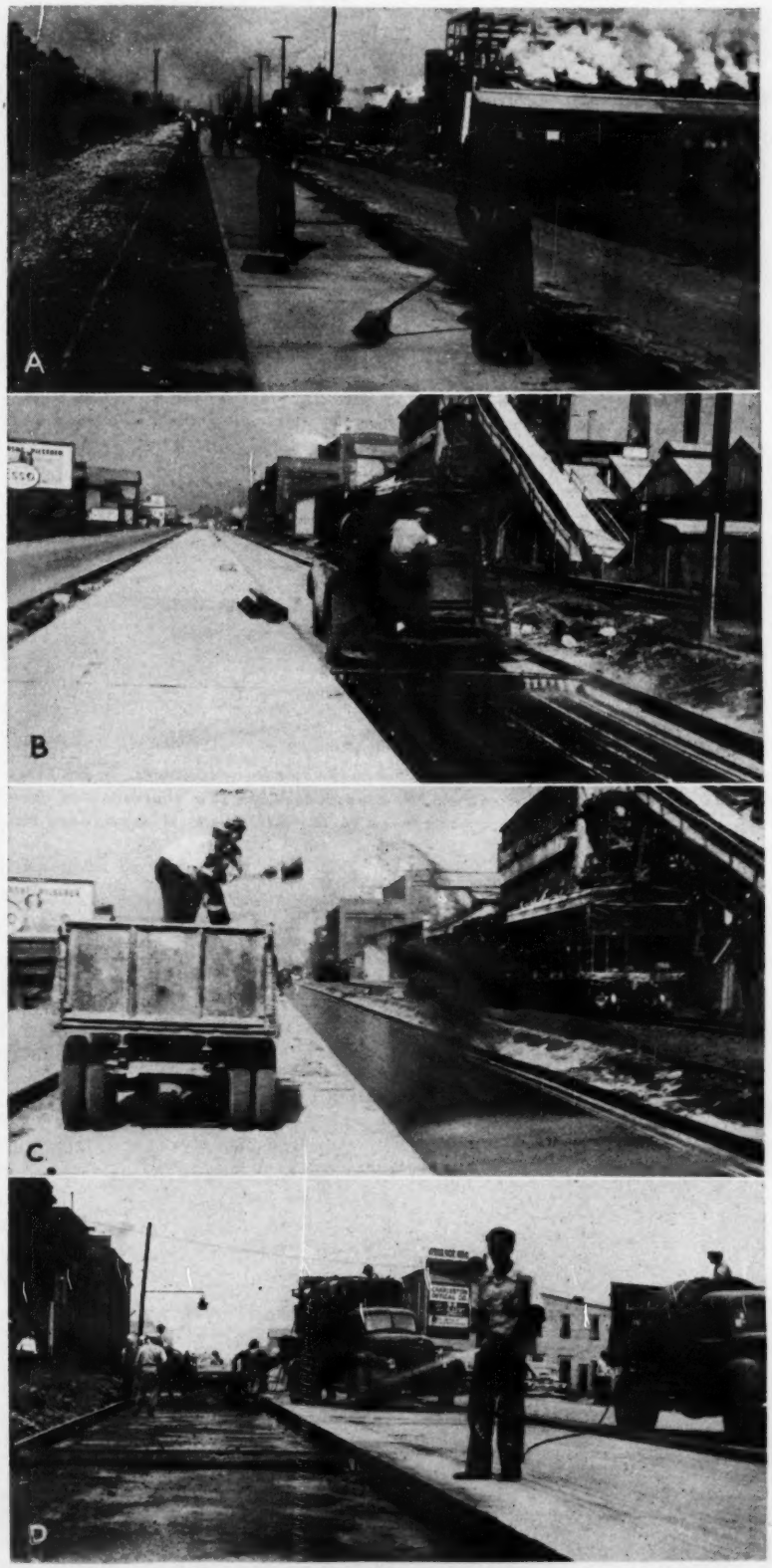

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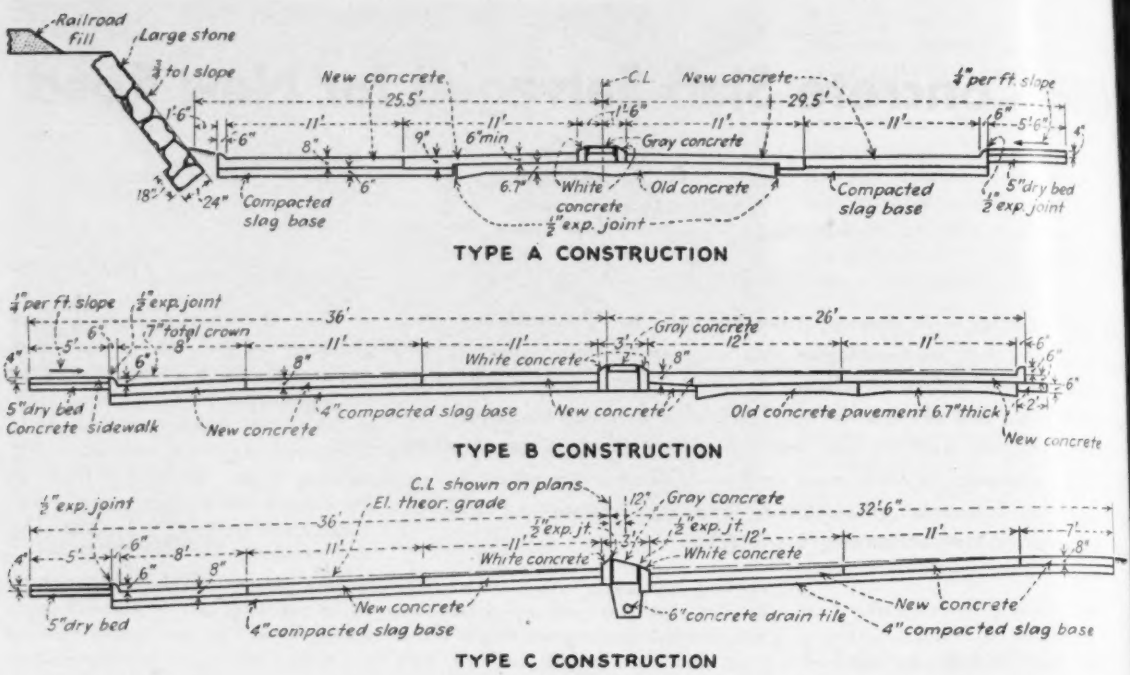

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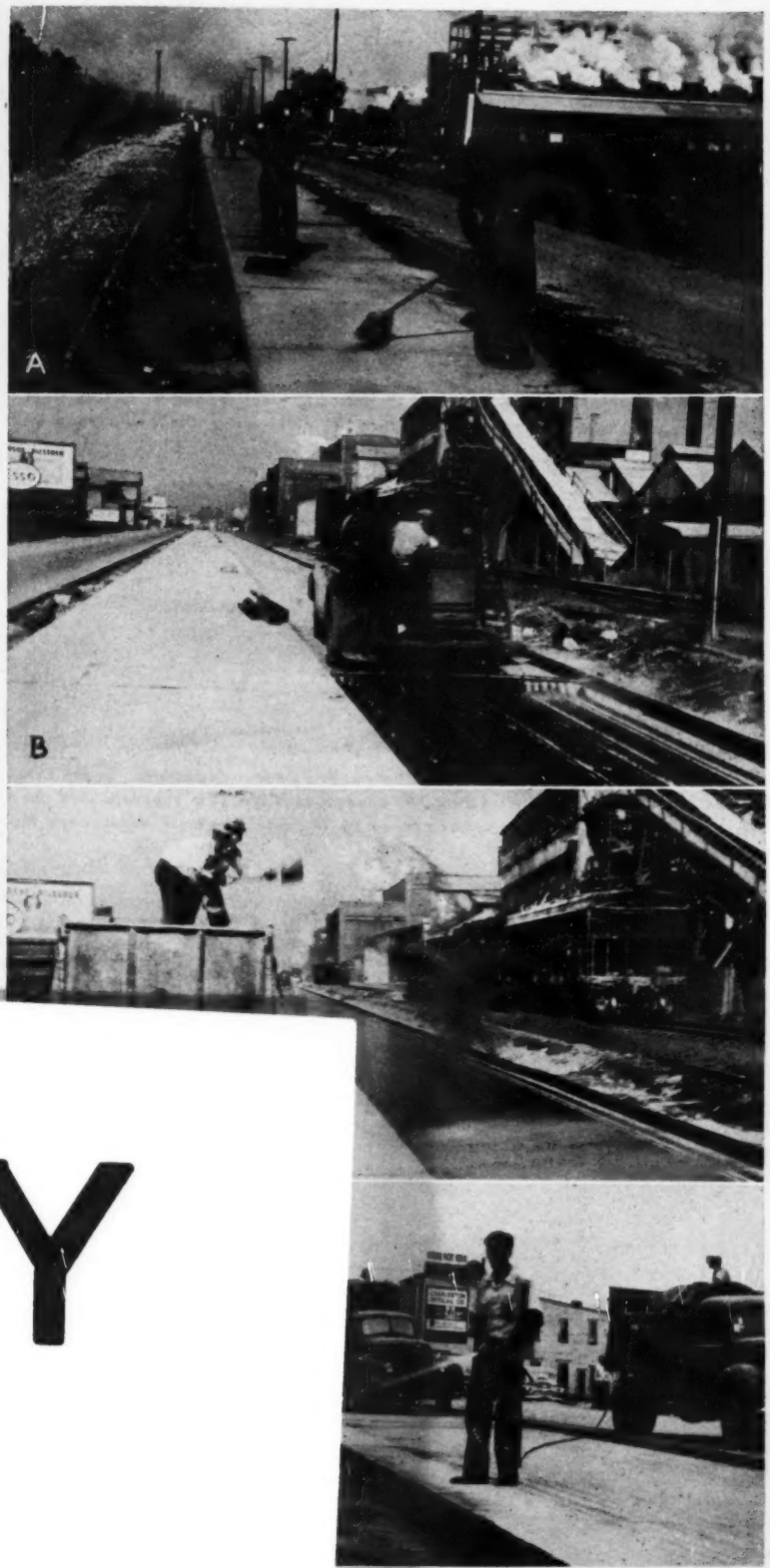

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Fig. 4. To build rigid forms on the old slab, over-size holes for the ¾-in. dia. stakes were prepared with pneumatic drills. Next the holes were filled with sand and the stakes driven.

Fig. 5. Forms for the first lane of the new roadway nearly complete. In the foreground a subbase of coal mine slag has been added; the new concrete slab over this base will be 8 in. thick as compared to the 6-in. minimum depth over the old pavement.

Fig. 6. Finishing the integral curb for the last of the four traffic lanes to be built.

Fig. 7. To reduce the use of steel, catch basins are located back of the curb where they can be protected by aconcrete cover requiring little reinforcing steel.

The equipment for batching, mixing and placing the concrete had no unusual features. Sand and gravel from the Ohio River were used and these materials were delivered to the proportioning site by barge. The gravel arrived in two separate sizes which were combined to form a gradation ranging from ¼ to 2 in. Conventional weighing equipment delivered the 12-bag batches of cement to the 2-cu.yd. transit mixers employed for manufacturing and delivery of the concrete.

How traffic was handled

Because traffic on U. S. 60 at South Charleston at times amounted to 1,800 vehicles per hour and averaged 19,000 vehicles daily, careful preliminary study of the construction procedure was necessary. A side road was available for traffic in one direction, and this route was used to by-pass all the east-bound traffic. Thus, along the new highway only one through lane had to be provided at all times. Gaps were left in the new construction for the necessary cross-overs at intersections. Later these were built of high-early-strength concrete.

A complement of full-time flagmen were employed during the paving operations and, with the aid of the South Charleston city police force; no greater delays to traffic resulted than might have been occasioned by ordinary traffic lights. Considering that the peak of traffic was 1,800 vehicles per hour at these times when workmen were going to and returning from their shifts at the nearby war plants, the traffic handling problem was solved in an unusually efficient manner.

Engineers and contractors

Contracts for the work described were let May 4, 1942, with completion specified within 150 days. McHugh Brothers, Springfield, Ohio, were the contractors. Chas. H. Boggs was resident engineer in direct charge for the State Road Commision of West Virginia, for which M. L. O'Neale is chief engineer; George W. McAlpin, state construction engineer; and M. Earl Campbell, construction engineer for the district of which South Charleston is a part. For the Public Roads Administration, which furnished funds for a large part of the construction cost, William Brewster is district engineer in West Virginia.

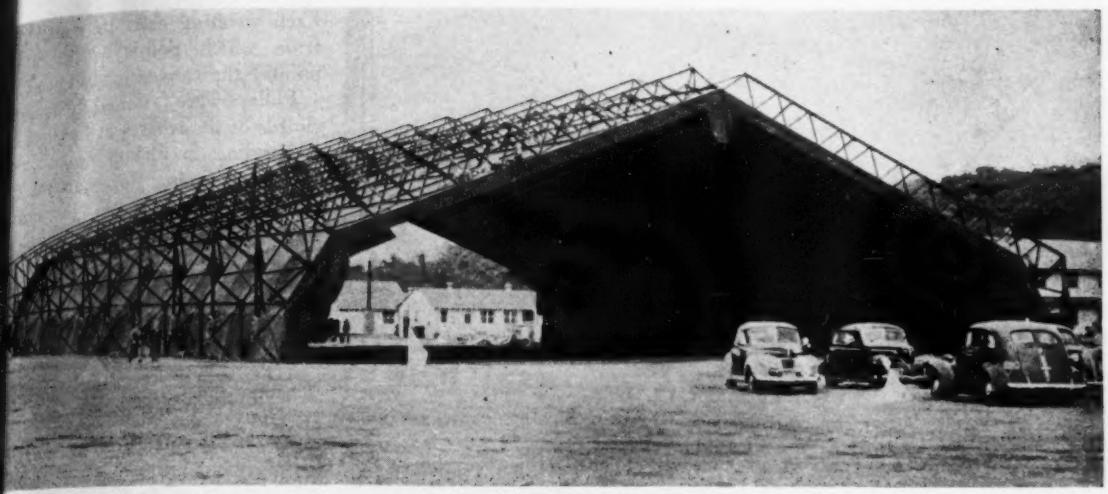


Fig. 1. Portable airplane hangars with light weight steel trusses used for combat duty by the U. S. Army Air Forces.

Steel-Frame Portable Airplane Hangers

W. B. Larkin

Manager, Steel Building Division, Butler Manufacturing Co., Kansas City, Mo.

***Contents in Brief**—Airplane hangers of novel design and construction have been developed for use in combat zones. Transverse bents, supporting canvas roof covering, were designed as tied, three-hinged arches to permit erection on uneven terrain and also to produce a building that is resilient to explosive forces. By using relatively high design stresses, light weight trusses were obtained which can be economically transported by air to erection sites. Duplication of truss details simplified and speeded erection.*

CLAIMED TO POSSESS the "mobility of a circus tent," a light-weight steel airplane hangar of unusual design and construction has been developed recently by the U. S. Engineers and the Army Air Forces.

The first building constructed was a combat hangar 130 ft. wide and 160 ft. long with a minimum center clearance height of 39 ft. A three-hinged, steel arch truss, tied at the base, formed each transverse bent, as this shape most nearly fit the clearance requirements and also provided a statically determinate structure.

Since these hangars are not of permanent construction, the design allowable bending stresses in the trusses was 50 percent over those adopted in 1939 by the A.I.S.C. for design of steel buildings. Adoption of hinged joints at both the peak and base of trusses provide a flexible bent having a minimum stress variation in the event of yielding foundations, and they also can be erected on a fairly irregular terrain. Since the arched-trusses are tied at the base with steel rods, bearing pads only provided sufficient support.

Several remarkable construction features are incorporated in these combat structures, one of which is that their relatively light weight permits them to be flown to the erection site complete in all details, including the necessary erection equipment. Trusses can be quickly erected or dismantled by unskilled labor, and the hangars are easily camouflaged to prevent enemy detection.

Although the buildings are of sturdy construction, they are fabricated in such a way as to be fairly resilient due to the possibility of their being exposed to explosions. Most of the structural members in the hangers are made from strip steel, and cold-formed by rolls into structural shapes. By varying the gage of the metal involved, the design requirements of all members were closely met.

All truss members were made identical wherever possible to eliminate the number of different pieces required for a hangar. In order to reduce shipping space requirements, truss members were proportioned to be shipped one inside the other. Another outstanding feature was a cleverly-designed drift bolt for connecting truss members, which greatly reduced required erection time in the field.

Canvas roof covering

Flame-proofed canvas covers the hangers. It is light in weight, can be easily transported by air, may be erected quickly, is resilient to explosion force, and may be easily repaired. Canvas sections were completely fabricated and needed only to be assembled on the job by lacing, similar to the procedure on large circus tents. Webbing reinforcements, sewed to the canvas section, carry the roof load to the steel frame truss.

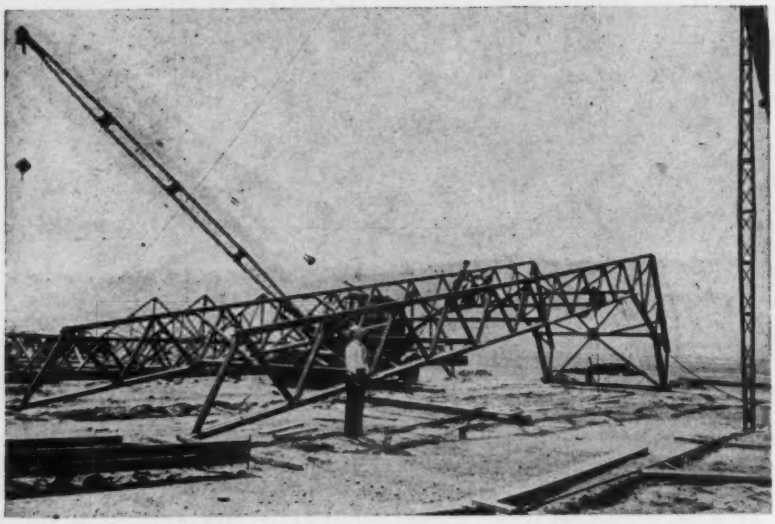


Fig. 2. Half-sections of steel trusses were assembled in pairs, raised into position by gin poles and supported until the corresponding sections were erected. Truss sections were rotated vertically about the supporting pins at their bases.

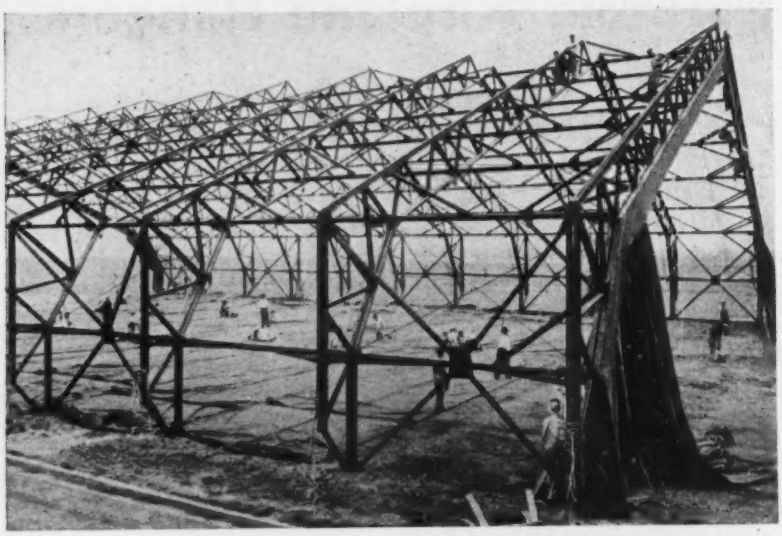


Fig. 3. Trusses designed as three-hinged arches, tied at the bottom with steel rods and supported on pin-bearing bases can be erected on irregular terrain, yet they provide a semi-rigid structure.

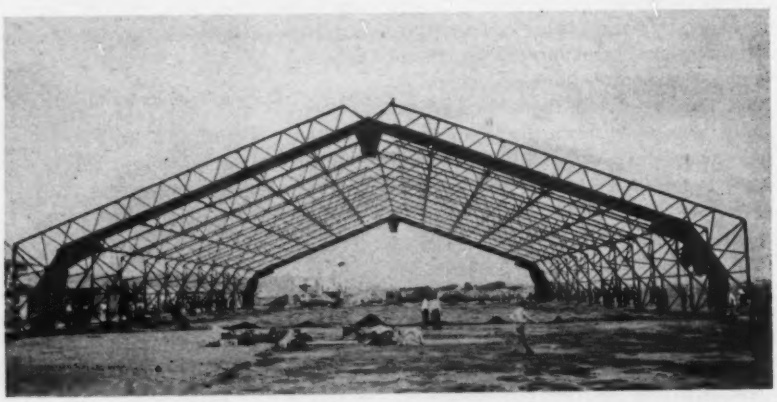


Fig. 4. Canvas roof was first assembled on the ground then raised as a unit.

Each webbing ends in a steel ri from which points (called pick points) the canvas is suspended.

Pulleys were fastened to the bott chords of the trusses at locations co responding to pickup points on t canvas sections. Ropes, attached the pickup points on the canv run over the pulleys, then parallel the bottom chords over sheaves pr vided for that purpose, and a secured to rope cleats on the tru about 4 ft. above the ground.

Canvas also incloses the ends the buildings. Each inclosure is two halves and the top of the cu tains are suspended by a troll arrangement from a track, which turn is secured to the bottom cho of the end truss. When this canvas released, the doors are opened b gravity to almost full size. To perm a minimum amount of drag on t ground, the center or high part of t canvas is draped as it is lowered.

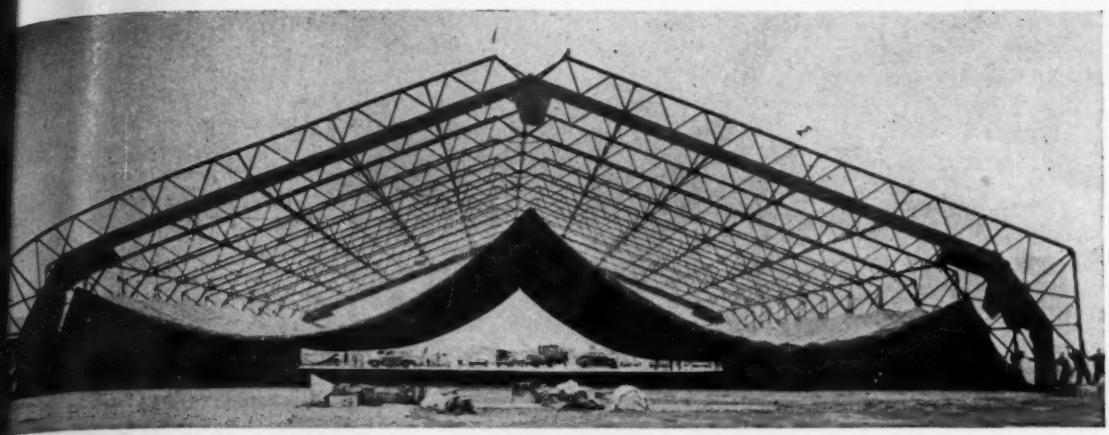
Erection of trusses

The practicability of this type a structure was displayed during t erection of the first building, whic also brought out several interestin facts. A novel procedure in erecti the trusses utilized the possibiliti offered by the hinged pin at the ba of the bent. The method used was t assemble one complete bay, consis ing of two half-trusses with long tudinal bracing, half way across t building on the ground, then rotatin this pair of half-trusses vertical about their base hinge pins, up in final position.

To accomplish this erection of t bents each half-truss was assembl flat on the ground in two parts, on being haunched section, and the oth the straight section which has paralle top and bottom chords. A pair o haunched sections were raised into vertical position and their later bracing then installed. The section were then rotated about their bas pins to a position where the haunc was high enough that, when th straight sections were connected, th center (or peak) of the truss touched the ground.

Gin poles raise assemblies

Two gin poles then raised th assembled straight section for co necting to the haunched sections, aft which, the entire one-half braced ba was rotated vertically about the hing pins into its final position. Suppor



. 4. After flame-proofed canvas roof was completely assembled on the floor of the hangar it was raised to position as ult. Ropes fastened to the canvas passed over pulley on the trusses, along the bottom chords, and over sheaves to rimes on the ground.

ere placed under the free ends of e half-trusses until the correspond- sections on the other side of the ilding could be erected, and the nter connections made in the air. Canvas roof-wall sections were read out on the ground across the ilding in their respective locations. ll sections of canvas were laced to- ther and ropes hung from pulleys ttached to the trusses were fastened the various pickup points on the nvas. The entire section of canvas r a building was raised in one oper- ion. Two or three erection men were stationed at each rope pull-up station, and an untrained crew required only 8 min. to raise the canvas for the first building.

Adaptable for many uses

Besides being used as a combat airplane hanger, this type of structure can be adapted for other uses such as barrage balloon repair units, recreation buildings, auditorium and training shelters. Another important feature is that whenever insulation is required for extreme cold weather or heavy snowfalls, an ordinary wood or steel roof can be applied to the top chord of the trusses without affecting the installation of the suspended canvas, since it is attached to the underside of the trusses. Consequently, even though these structures are intended primarily to be temporary, they can be converted easily into permanent buildings.

Fabrication and development of the buildings was by the Butler Manufacturing Co., Kansas City, Mo., W. L. Smith, chief engineer, under the supervision of the U. S. Engineers of the Army Air Forces.

Salvaged Creosoted Piles Good After 25 Years

In times of priorities and shortages n most construction materials, sound nd usable timbers and piles may ften be obtained by salvage opera- ions on obsolete structures. Dur- ng the past 10 years, the engineering epartment of Barber County, Kan., as made a practice of salvaging reosoted piles from branch railroad ines abandoned within the county, r nearby, according to a brief de- cription in the January issue of *Wood Preserving News*.

The first group, 168 in number, was pulled in 1932 from a Medicine River bridge built by the Atchinson, Topeka & Santa Fe Ry. Three years later 201 more piles were extracted from other structures along the same dismantleed branch line. Similar abandoned bridges on the road east of Geuda Springs yielded 193 additional piles in 1936.

In all, from these salvage operations the county obtained 562 southern yellow pine piles pressure treated, with a final retention of 16 lb. of creosote per cu. ft. The piles, which totalled about 10,000 lin. ft., were treated between 1908 and 1918, and the major portion installed in 1916. In general, they were removed from the ground by excavating around them and by pulling with a cable over an A-frame with the power supplied by a 60-hp. tractor.

Preparation prior to redriving

The only preparation of the piles, prior to redriving, consisted in cutting off the upper 10 in. of the butts to remove drift bolt holes, end checking, or defects due to long exposure. After removing this short section, a salvaged pile could be redriven as readily as any new pile. In 1934 the county began redriving the creosoted piles in the bents of its own treated timber bridges.

During an inspection in 1942 of all bridges in Barber County, it was noted that the salvaged piles were in excellent condition with the exception of two. These piles showed minor defects resulting from an improper placement of the follower block during the second driving. It also appeared that the piles, which had already served for 25 years, will continue to serve satisfactorily for at least another quarter of a century or more:

All operations involved in the salvaging and redriving were carried out under the supervision of L. A. Tilton, county engineer of Barber County, with headquarters at Medicine Lodge. L. H. Nurse was county bridge engineer.

Fig. 1. Concrete prepared by mobile mixer is delivered by crane with 1-cu. yd. bucket for box-drains at a mid-west airba

Multiple-Box Drain for Airbase Runoff

***Contents in Brief** — Construction of a long, reinforced-concrete box drain of 600-cfs. capacity at an airbase was carried forward in alternate 75-ft. sections. Floating forms of the all-bolted type were used and two pours were required for each section, one as the bottom slab and the second as the sidewalks and roof. Concrete, which was mixed by a paver, was delivered by a 1 cu. yd. bucket handled by a crawler crane. A 110-man crew built as much as 600 ft. of drain weekly.*

BECAUSE of much preliminary planning as to the most satisfactory type of forms and construction procedure, a Mid-west contractor made rapid advancement with a small crew in building a reinforced-concrete, multiple-box drain for an airbase. As a result, the drainage facilities became available in a short time to permit early completion of the airbase to aid in winning the war.

The box is part of a $2,500,000 drainage system for a 4-sq.mi. area. It includes 224 ft. of 5½x6-ft. single box, 1,438 ft. of double box and 3,391 ft. of triple box. All of the passages are of the same size except that for the last 130 ft. of the triple box the side cells are 10x6 ft. The runoff from the major portion of the area is collected in the lower end of the drain, which has a slope varying from .00111 to .00165. Its capacity at the lower end, where the steeper slope is possible, is estimated at 600 cfs., as determined by Kutter's formula with "n" equal to .013.

The bottom of the drain is 10½ in. thick, the exterior vertical walls 8 in., the intermediate walls 6 in., and the roof 9 in. The drain will be covered by an average of 3 ft. of earth. Every 300 ft. a 3x3-ft. manhole is required and 2½x5-ft. access openings in the intermediate walls are required on this same spacing. In addition, on 25-ft. centers 9x12-in. openings are required at the base of the intermediate walls. The larger openings are to permit workmen to enter all three boxes from the same manhole; the smaller openings are to equalize at all points the water pressure on both sides of the intermediate walls of the drains.

Working in wet ground

The outfall is being constructed where the soil varies from a very fine sand to very fine clay. In some cases where the clay was encountered the contractor chose to remove the excavation to a greater depth than necessary and to backfill with rock and sand. This work permitted much dryer working conditions. Excavation for the box is by a crawler crane with a 60-ft. boom and a 2½-yd. dragline

kot. All spoil is placed to one side later used for backfill.

Temporary ditch parallels drain

Because the groundwater is but a feet below the surface during h of the year, a temporary drain- ditch was excavated parallel to roughly 100 ft. east of the drain lower groundwater over the entire d. Although this ditch, which was to a depth of about 2½ ft. below bottom of the box, has been very ctive in eliminating trouble from r, as an added precaution the con- tor is constructing just east of box sewer and about 1 ft. below lowest concrete a 12-in. dia. longi- inal concrete tile drain with open ts. The backfill around this drain ¼-in. crushed stone. On 50-ft. cen- under the box transverse trench ins filled with stone connect to longitudinal tile.

Pumps and well points used

Construction of the drain started he lower end and an 8-in. centrifu- pump operating 24 hr. per day the outlet of the longitudinal tile in has been able to keep the bot- n of the trench free of water at all es. The drainage of the open nch is further aided by the fact t the contractor obtains water for concreting operations from about wellpoints of 2-in. dia. and 32 ft. length. The discharge from these its, which are on the suction line a 6-in. pump operating as fre- ently as necessary, is into a small nd excavated by a clamshell

Fig. 2. Chutes used in placing concrete for bottom slab are moved about by hand. Supports consist of two 2x10-in. longitudinal timbers 26 in. apart.

bucket roughly 150 ft. to one side of the trench.

Drain built in 75-ft. sections

Concreting operations for the single, double and triple box sections are very similar and only those for the larger size will be described. Construction is by two overlapping shifts and operations continue from 6 o'clock in the morning until about 9 o'clock in the evening. The boxes are built in alternate 75-ft. monoliths and the ends of the sections are painted with asphalt mastic to provide planes of weakness at the joints, which are keyed, as shown by an accompanying photograph. Two pours are used and with the first the bottom and 7-in. high section of the vertical walls are built. Next, the interior forms are erected and the sides and roof built as one operation.

Forms of the all-bolted, floating type are employed. They are made up of ¾-in. plywood and in panels 4 ft. wide and 8 ft. high and with 2x4-in. yellow pine studs on 16-in. centers. The exterior vertical forms are built continuous, although the concrete is placed in alternate sections, and they are erected on 2x12-in. oak mud sills laid flat and hand tamped in place. To hold the exterior forms in place, along each form at the bottom 2x4-in. horizontal oak braces on 4-ft. centers are used. On this same spacing 2x4-in. diagonal oak braces lead from a point about 4 ft. above the bottom of the form to the stakes holding the horizontal braces in place. In addition, 2x6-in. braces about 10 ft. long and on about 8-ft. centers extend from the top of the form to stakes driven into the slope of the trench.

Forms permit work on bottom

On the inside and between these forms yellow pine spandrel girts on 6-ft. centers are used; these members are 2x10's at the top and 2x8's at the bottom. The lower girts clear the bottom of the trench sufficiently to permit construction of the bottom slab, and, as shown by an accompanying photograph, they carry 2x4's that support the screeds employed in finishing the bottom. They also support the 2x8-in. longitudinal timber used as forms for the short section of the

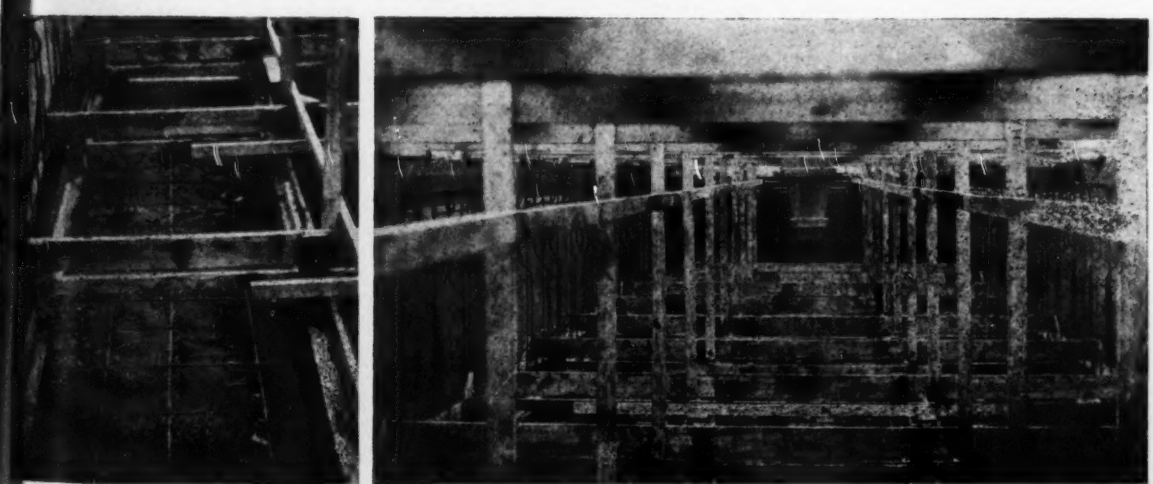


Fig. 3. The floating, all-bolted forms completely erected and the reinforcing steel in place to permit construction of the bottom slab. Chutes of the type shown in background of right picture delivers concrete to the point desired. Because few bolts need to be removed, the forms may be dismantled very quickly. Left photo was made at a lower level to show additional details.

vertical walls. These girts are supported by a longitudinal 2x4-in. timber bolted to each exterior form on the inside and by two rows of 2x4-in. verticals between the girts.

The top girts carry six rows of 2x10-in. longitudinal scaffolding; two of the 2x10's are used over each of the three boxes and each pair are 26 in. apart to support the hoppers for placing the concrete in the bottom slab (Fig. 3). To assemble the forms for the first pour, rapid work is possible since only 12 bolts need be added for each of the bottom girts and but two for the top-girts.

The panels for the interior forms are of construction similar to that for the exterior forms. In pouring the sidewalls and roof as a unit, 4x4-in. longitudinal split walers on 22-in. centers are used with splice ties to hold the inner and outer forms together. To support the roof panels a 4x4-in. longitudinal purlin is used in the center of each box (Fig. 5). This timber is supported by 4x4-in. shores on 5-ft. centers; the wedges and blocks are of oak. The side panels are removed after two days, but the roof panels are left in place for seven days.

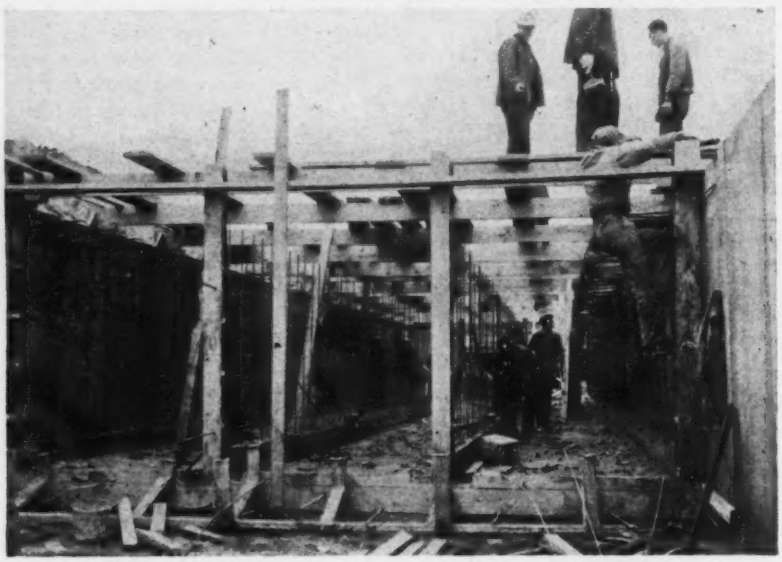


Fig. 4. With bottom slab complete, lower spandrel girts and bottom framing are removed and longitudinal steel for vertical walls added; vertical steel for walls was installed with construction of the bottom pour.

Fig. 5. Vertical forms, both inside and out are removed two days after construction of the sidewalls and top in one pour. The roof forms, which are supported by a single 4x4-in. longitudinal timber and 4x4-in. shores on 5-ft. centers, are left in place 7 days.

Specifications call for 6-bags cement per cubic yard of concrete a a strength of 4,500 psi. at 28 da The maximum water content is gal. per cu.yd. and the mixing ti is 1½ minutes. Co- rete materials a delivered in 6-bag batches by eig trucks from a dry batching pla about 4½ miles from the job. Mixi is by a paver and the concrete is d livered to the forms by a crawl crane handling a 1-cu.yd., botto dump bucket. Normally when t outside temperature is below 38 de F. the water for the concrete is heate by a small steam boiler; this mak possible more rapid setting of t concrete and permits earlier strippi of the vertical forms.

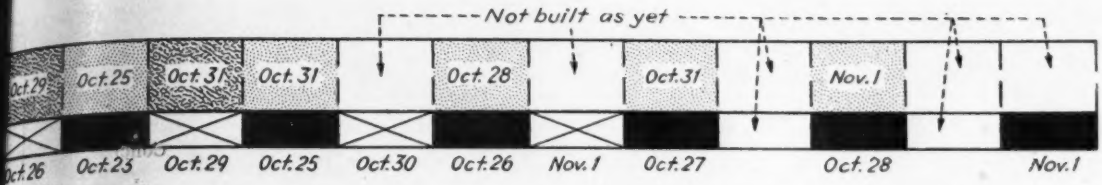
Forms used many times

Moving the forms forward as co struction progresses is by truck. B cause of their sturdy construction the forms may be used many times The 2x12-in. mud sills may be em ployed as many as 50 times withou being repaired and the plywood form as much as 10 times before major re pairs are required; some of these forms are used as much as 20 times without repairs being necessary. The faces of the forms are cleaned and oiled each time they are moved.

In constructing the drain in alter nate 75-ft. sections and in two pours the crews sometimes place concrete at points as much as 675 ft. apart. An accompanying diagram shows the placing operations for a typical week. Because of the slow delivery of sand and gravel, small crews have been employed. A normal crew consists of about 110 men, including common laborers, carpenters, truck drivers, crane operators and reinforcing steel setters. The 110-man crew can aver age 600 ft. of triple box weekly; much more rapid construction would be possible if materials could be ob tained at a more rapid rate.

Addition of reinforcing steel

In placing the reinforcing steel about 40 percent of the bending work is done on the job. When setting steel for the bottom slab (Pour A), the vertical steel for the walls is also set. To set the 3,800 lb. of steel required for 75 ft. of the bottom slab and for the walls requires about 5 hr. for a crew of 4 steel setters and 3 helpers. Placing the 1,200 lb. of reinforcing steel for the roof the 75-ft. section requires only about two hours



g. 6. Typical 7-day schedule of concrete placing. Sometimes the bottom slab is being built 625 ft. ahead of where the last ncrete is being added for a closing section.

work for 2 steel workers and 1 lper.

Curing of the completed sections accomplished by adding with spray umps a membrane curing compound film at a rate not to exceed 200 . ft. to the gallon. Backfill follows bout 14 days after construction of e box, and for this work the original cavated material is used. The fill added by a 2-cu.yd. clamshell ucket handled by a crawler crane. is generally placed in 6-in. layers nd compacted with bulldozers oper- ting on the freshly placed material. However, under the runways and axiways and where drainage pipes oin the culvert, it is placed in thinner ayers and compacted by tamping.

Fig. 7. At 300-ft. intervals 4-ft. square manholes with precast concrete covers are required. Height of interior form in place indicates depth of backfill required over box culvert.

Construction of the drainage system is by a combination of Drainage Contractors, Inc., and Nolan Construction Co., with A. Thompson, field superintendent. Vernon C. Dutton served as superintendent on construction of the drain. Warren & Van Praag, Inc., architect-engineer for the project, are represented by Alex. Van Praag, Jr., project manager, and by M. H. Kinch, engineer in charge of the drainage work. The work is being done under the direction of Col. Henry Hannis, Louisville District, Corps of Engineers, U. S. Army, who recently replaced Col. Henry Hutchings, Jr., as district engineer. Capt. Jean P. Case is area engineer on the project.

Engineering Students in Canada Urged to Finish Courses

Canada's appreciation of the wartime value of engineering training was emphasized in a talk recently made before students of Rose Polytechnic Institute by L. Austin Wright, general secretary, the Engineering Institute of Canada. The following has been taken from Secretary Wright's address.

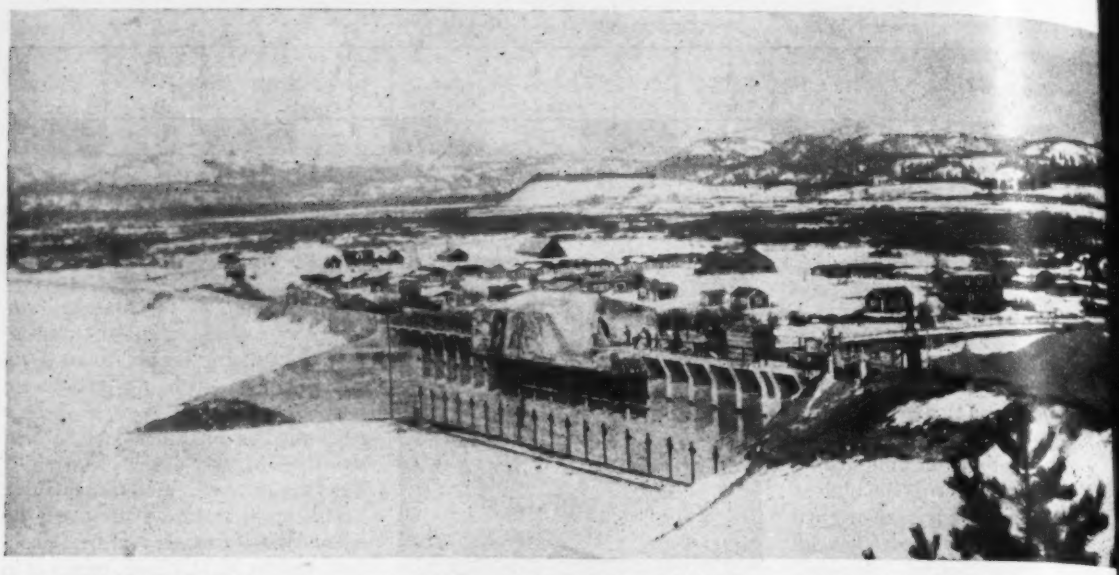
"In Canada we have put a fence around groups like yours. In all our universities we have forbidden the armed services to contact you; we have prevented industry from approaching you; we have protected you until your education could be completed and until your final disposition could be arranged in strict accordance with the national need. To us the engineering student has been a precious war material, the supply of which must be guaranteed, the quality maintained and the distribution controlled.

"With us no student may fail an examination else he is denied the privilege of continuing his studies; no student may change his course; every student medically fit must take his military training; a student may be allotted to the division of the service he prefers providing there is need for him; upon graduation students not called to the armed services will be allocated to industry.

"These controls are exercised by the Wartime Bureau of Technical Personnel, an organization operated by three national engineering societies under the authority of the Minister of Labour. In this manner the distribution of engineering and science students, as well as graduates, is controlled by the profession itself. We have found it advisable to have this work done by a neutral body that has regard to the whole picture and not just one side of it and is competent to evaluate needs and to appraise technical qualifications.

"We have not accelerated our engineering courses. It still takes full four years plus one preparatory year, which we call 'pre-engineering' to complete the course. The advisability of accelerating was investigated thoroughly and somewhat to our surprise we found that no one was in favor of it. Industry and the services were unanimous in stating they wanted only graduates who had completed the full course and who had the practical experience gained during what we facetiously call the 'summer vacation.'"

Canada's Wartime Bureau of Technical Personnel was set up about two years ago by the common action of Canadian engineering and scientific societies. Subsequently it was transferred to the Ministry of Labour. In addition to its control over engineering training, it also exercises control over engineering and scientific personnel. Technical personnel must notify the bureau when they leave one job and may not be reemployed on other work without a certificate from the bureau.



Weather shelter for new concrete roadway deck on Jackson Lake Dam moved along as work progressed.

Highway Over Dam Rebuilt in Winter

Contents in Brief *— In temperatures ranging to 35 deg. below zero an old 10-ft. highway bridge across Jackson Lake Dam in Wyoming was replaced by a 20-ft. concrete bridge, requiring alteration of gate piers and machinery. Sections of the job were completely housed inside structure made up of working platform, forms and canvas shed.*

SEVERE WINTER WEATHER in the famous Jackson Hole Country of Wyoming failed to halt reconstruction of a highway bridge over Jackson Lake Dam. While snow and frigid winds swept down from nearby Grand Teton peaks, demolition of the old bridge, rearrangement of gate operating machinery and building of the new concrete bridge proceeded without interruption under the protection of wood and canvas housing combined into one structure with a working platform and concrete forms.

Although the sub-zero temperature of —35 deg. encountered was less severe than anticipated, it was necessary to prepare for more extreme conditions, and extra heating units were always available. No working time was lost on account of bad weather despite the fact that several days were very disagreeable for men working in the open.

U. S. Routes 89 and 187 formerly crossed the dam (a concrete overflow structure built by the U. S. Bureau of Reclamation in 1910 and raised in 1916) on a dangerously narrow 10-ft. wooden deck supported on the concrete gate piers. Not only was the bridge a hazard to highway traffic to and from Yellowstone Park, but the arrangement of gate operating machinery close to the roadway on both sides placed the gate operators in constant danger from vehicles, so that the need for a new deck was obvious.

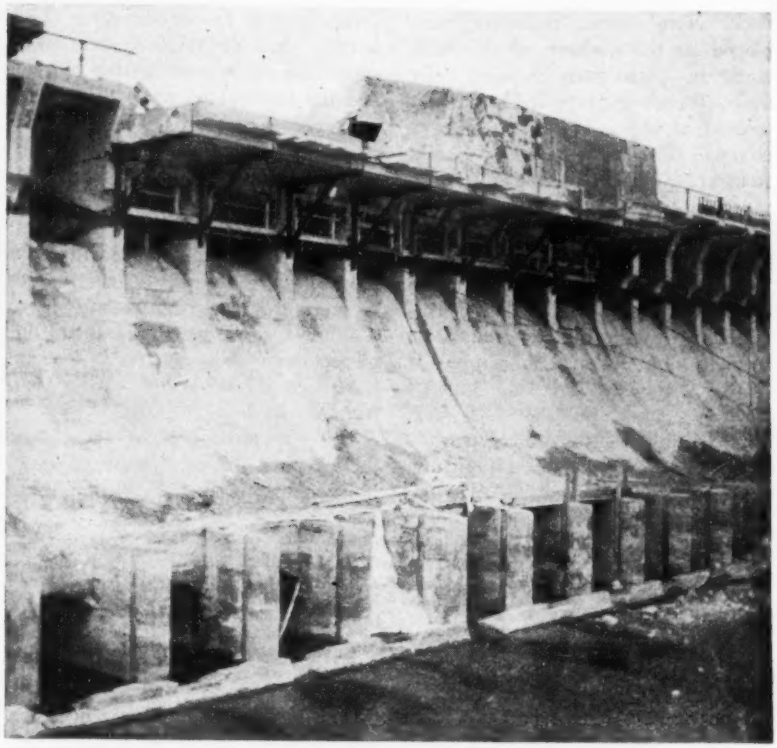
Plans for the new construction provided for the demolition and removal of the entire existing reinforced concrete and timber deck of the bridge, 220 ft. long, including the demolition and removal of the top 2 ft. of existing pier walls which support it 14.5 ft. above the concrete spillway. The pier walls were then to be rebuilt to approximate original height and a new deck of reinforced concrete constructed, providing a 20-ft. clear roadway, a 9-ft. sidewalk on the upstream side and a 5½-ft. sidewalk on the downstream side of the dam. These sidewalk widths would accommodate the gate lifting machinery.

The agreement between the Bureau of Reclamation and the Wyoming Highway Department covering this work provided that the highway department bear the entire cost, that there be no interference with the release of irrigation waters from the dam and that all designs and construction procedures be subject to the approval of the chief engineer of the Bureau of Reclamation. As it developed, the designs were prepared jointly by the Wyoming Highway Department at Cheyenne, and the Bureau of Reclamation at Denver.

The severe weather conditions that are prevalent during the winter months at Jackson Lake Dam necessitated a well planned procedure and extreme precautions in construction to insure a satisfactory job. Initial operation was to erect falsework under the existing deck to provide a working platform; to support the removed concrete so that it could be collected and disposed of; to support the forms and concrete of the new deck; and to support a weather shelter overhead as well as to serve as the shelter on the underside.

The central position of the falsework was constructed of timber and

rected on the crest of the spillway, while the overhanging sides, upstream and downstream were supported by structural steel brackets held in place with anchor bolts and tie rods. A sufficient length of falsework was provided so that while the new deck was being built in one section of the bridge demolition work in an adjacent section could be carried on. At the completion of the curing period for the concrete, the falsework was dismantled and moved ahead, all heavy timber and steel brackets being lowered with a hand windlass and raised into position with a dragline.



Falsework built up from spillway face supported deck forms and mobile weather shelter. Old bridge deck at left, completed section of new bridge at right.

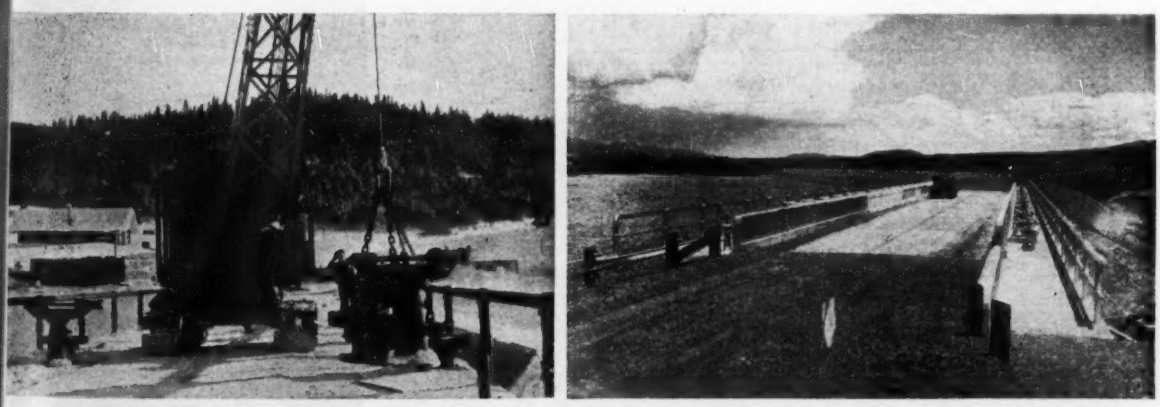
Explosives break concrete

In demolishing the old bridge, the slabs and ends of the beams adjacent to the pier walls were broken down with a 2,700-lb. hammer handled with a dragline and dropped from 6 to 12 in. Longitudinal reinforcement was cut as soon as exposed. Pier tops were removed by blasting. Horizontal holes were drilled in the pier walls at about 18 in. centers and about 3 in. above the established cutoff to assist in preventing overbreak of concrete. Vertical holes were also drilled in the top of the pier walls at about 30 in. centers. The number of holes to be shot at any one time was limited to two. Charges were limited to one-quarter stick of explosive per hole and blasting commenced at the center of the pier walls. It was found advisable to remove the required portion of the concrete haunch at each end of the pier wall prior to blasting. Final trimming and cutting of keyways was accomplished with paving breakers and air driven chipping hammers. All demolished concrete was disposed of in the river channel.

All concrete was Wyoming's standard Class AA, having a required minimum ultimate compressive strength of 2,700 lb. per sq.in. High early strength cement was used, and sand and gravel aggregate was obtained from a nearby source. freezing of the exposed face of the pit being prevented by a tarpaulin covering, inside which two salamanders were kept burning. A steam boiler was set up for heating the concrete aggregates and water, and the temperature of all concrete placed varied between 70 and 90 deg. F. The specifications required that freshly placed concrete be maintained at a temperature above 50 deg. F. for three days and then cooled at a rate not to exceed 20 deg. per day.

Protection from freezing

To protect the work a tarpaulin covered timber frame structure was erected with the bottom of its roof trusses about 6 ft. above the bridge



Comparison of old and new roadway decks over Jackson Lake Dam. Narrowness of old crossing is evident in left view showing removal of sluice gate hoists prior to deck demolition. In the new wider deck at right, gate hoists are in sidewalk spaces, protected from vehicles by solid concrete guard rails.

deck. Two steam radiators were placed on the decking of the falsework in each span between pier walls, steam being supplied by a boiler located at the base of the spillway chute. During extremely cold weather, additional heat was provided by two large gasoline burners, two salamanders, and six kerosene lanterns. This arrangement was found very satisfactory for maintaining a temperature above 50 deg. F.

Forms between the pier walls were made up in sections and supported on wood blocks and long tapered wedges resting on the falsework. After the joists between the pier walls had been sheathed with shiplap, the wedges were adjusted so that the forms were at proper elevation. The bottom mat of reinforcement was supported on precast mortar blocks, and the top mat wired to the screed supports. Forms for the parapet and curb walls were also made up in sections and sheathed with ¾-in. plywood.

Concrete was conveyed in buggies from the mixer and dumped directly into place where it was compacted by internal type mechanical vibrators. A 2-in. layer of sand was spread on all concrete slabs and kept wet at least two days. Walls were cured with wet burlap.

Prior to removing concrete from the existing bridge, the sluice gate hoists and top section of the stem had to be removed. The gate hoists were lifted with a dragline and the stems were screwed out. Upon re-installation the hoists were revolved 90 deg.

The bridge reconstruction was handled by Charles M. Smith, contractor of Thermopolis, Wyo., for whom W. R. Hanson was superintendent. The contractor's crew averaged about 25 men and the contract cost was $36,935. For the Wyoming Highway Department, W. H. Fisher is bridge engineer, Talcott Moore, construction engineer and V. H. Williams, project engineer. S. O. Harper is chief engineer for the Bureau of Reclamation, which was represented on the job by V. E. Larson.

Design and Construction Methods For a Tight Plug in a Concrete Dam

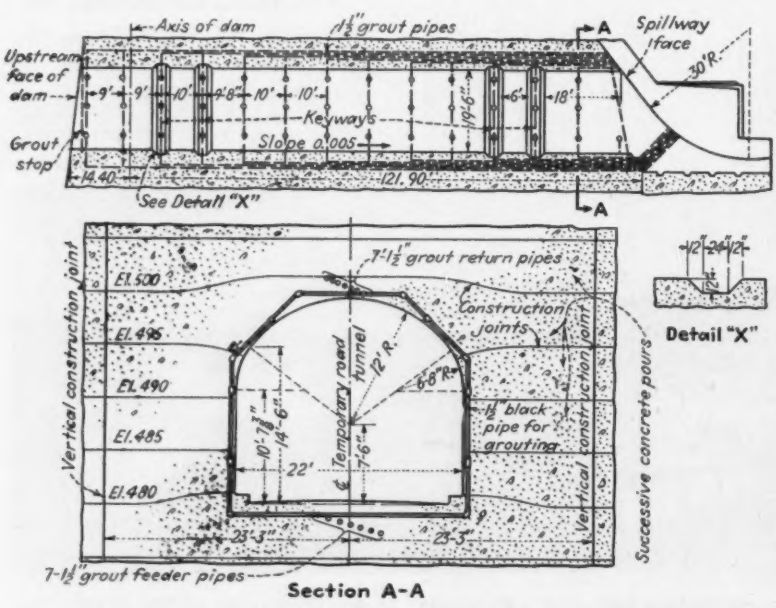
A typical problem in making a satisfactory plug in a concrete dam, to effect watertight closure of a roadway opening, was given careful attention in the design of San Vicente Dam at San Diego. Details of the design and methods employed are as follows:

Because the plug might have to be poured in two sections, it was decided that each section should have two keyways and be able to take care of shear resulting from the full pressure of water on the upstream face of the plug in case the dam is subjected to considerable load before the plug can be grouted. Each keyway has a depth of 1 ft. and is 4 ft. wide at the surface. To avoid sharp reentrant angles, fillets are used on the forms to make the 45-deg. angles shown in the section detail.

After concrete in the tunnel plug has contracted grouting is to be done, through the pipes shown in the drawing, which is expected to fill any remaining space between the plug and the seasoned concrete in the dam. Specifications emphasize the requirement that concrete surfaces in the tunnel be rough in order to provide additional frictional resistance.

From the drawing it is seen that grout pipes are led out to the downstream face of the dam where grout pumps will be set up when the time comes for grouting.

General features of the San Vicente Dam and the personnel responsible for design and construction were given in (*ENR*, Mar. 25, 1943, p. 406). The dam was built for the city of San Diego, Calif.



Section and elevation of the tunnel showing location of keyways and grout pipes. Right: Two of the four keyways arching over the present roadway tunnel through San Vicente Dam. .

Lean-Mix Concrete Used for Roads

● Experiments in forming highway pavements by rolling layers of lean concrete have been carried out in recent years by the Country Roads Board, Victoria, Australia, as a means for determining what economies could be made in the use of cement, which is a large item in the cost of road construction in that region. Now, due to war conditions, further economies in materials are necessary, and as a result, the board extended its studies last year. The following is extracted from the report of D. V. Darwin, chief engineer of the board, on experience to date with rolled concrete.

IN THE MELBOURNE AREA the Country Road Board has now a total length of about 8 miles constructed in rolled concrete, most of the length having been covered with a thin course of pre-mixed drag-spread asphaltic macadam. Portion has been left with the concrete surface exposed to traffic for several years, and presents quite a reasonably finished surface, now worn down to show a mosaic with a large proportion of stone.

For work near Melbourne there are considerable supplies of crushed basalt, but sand and cement have to be carted by rail about 30 and 50 miles respectively, so that concrete containing a very low proportion of mortar is particularly economical. The mixture which the board has adopted has generally been 1 part of cement to 2½ parts of sand, and from 10 to 12 parts of metal by volume. Since the beginning of the war a considerable amount of rolled concrete has been used on roads in and adjacent to various defense establishments subject to heavy commercial traffic.

Rolled concrete for runways

A further use for this type of construction has been developed where very large areas of runways and taxiways were required to be built in concrete, and economy in transport of ingredients was an important factor in the choice of rolled concrete. Previous road construction has generally been done with ½-cu. yd. concrete mixers producing about 80 cu. yd. per day; but where the larger areas have had to be built, in order to get a high rate of construction and bring the pavements into use in reasonable time, it was necessary to secure concrete pavers of 21 to 27 cu. ft. capacity, producing about 200 cu. yd. per day each. On large works such as these, where speed of construction is of great importance, the quality of finish is always very liable to suffer, and this is probably more noticeable with rolled concrete than with ordinary rich concrete.

When the small mixers were used the material was always spread from spreading sheets, but with the paving type of mixer a large proportion of the batch is deposited directly in place, with a resulting tendency for separation of coarse material from the mortar, so that the gaging of the thickness and the distribution of the material in a uniform manner is more difficult. Inequalities due to spreading are rapidly brought to light by initial rolling. To correct the inequalities, it is necessary to scarify high or low places and remove the material to a sufficient depth so as to allow fresh material to be placed by hand to the correct levels. It was found that the inequalities were very much more numerous with spreading by a paver than with the previous careful hand spreading. The strain on the finishing gang is thus considerably increased. After correction and rolling, the surface is tamped with a longitudinal stiff steel tamper 22 ft. long.

With harsh roller-compacted mixtures it is necessary to select from the material deposited a proportion of the richer material to place along the side forms, so as to avoid honeycombed edges. With large capacity pavers a little more attention to this was required. For a time, vibrators were tried to improve the finish of the edges, but were not found effective owing to the harsh nature of the material. With the precaution mentioned, the roller was quite able to cope with the situation and give a respectable edge finish.

In spite of the care taken with finishing, weather conditions sometimes were responsible for irregularities, rain either spoiling the surface directly by washing away the mortar or indirectly by softening the subgrade. The effect of enriching the mixture to 1:2½:8 was tried on one section of the work where the base was in an average moist condition, but it was found that the lubricating effect of the additional grout increased the mobility of the material, and the roller tended to bog, and, consequently, the finish was more uneven than previously.

In spite of the difficulty of finishing and the necessity of proceeding even under very unfavorable conditions, the finished work is quite serviceable, but a small amount of hand trimming of very rough areas by removal of the projections, together with a little patching with pre-mixed bituminous material of a fine-graded type, will be required on the sections most seriously affected.

Shrinkage cracks

On a rolled concrete road which was constructed in three continuous thickened-edge slabs, each about 12 ft. wide, the center slab was poured last, and tongue-and-groove longitudinal joints were used to afford load transfer; it was later noted that transverse cracks were about twice to three times as numerous in the center slab, and this was attributed to longitudinal restraint during initial shrinkage of the slab. For runway construction, therefore, the responsible engineers required complete edge separation of adjoining slabs, which were made of uniform thickness and provided with greased longitudinal dowel rods to minimize the effect of transverse cracks. At the end of each day's work, transverse expansion jointing was used.

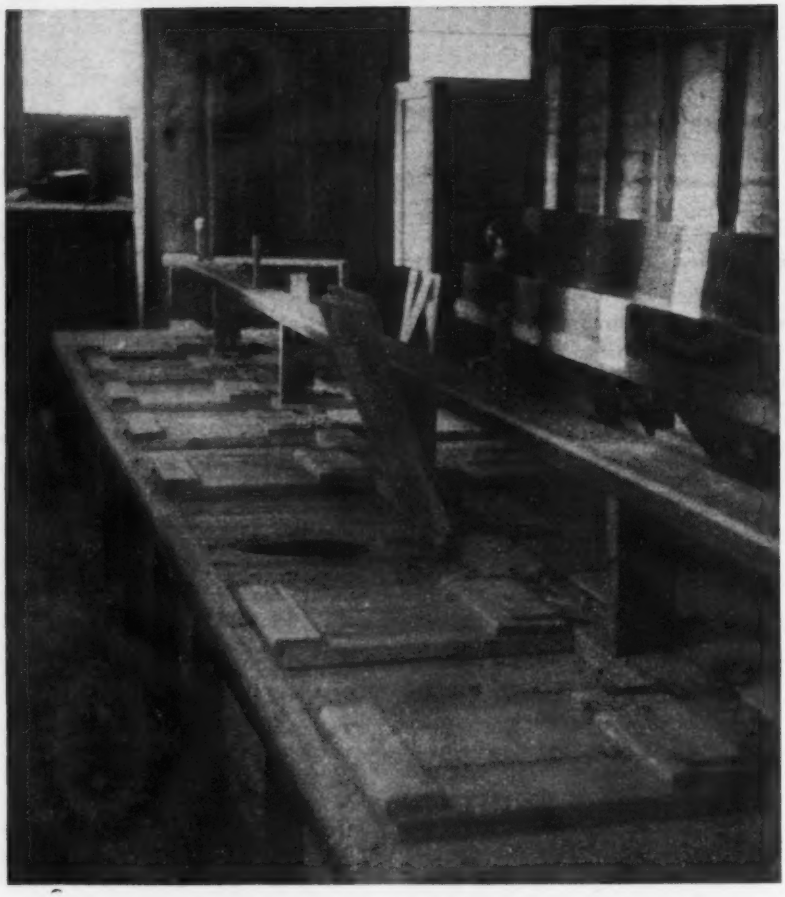


***Fig. 1. Experiment unit** of a communal lavatory for Army theater-of-operations cantonments. Concrete latrine pit with wooden top and a half-tile urinal trough (right background) is substituted for ceramic toilet fixtures.*

Army Lavatory Conserves Critical Materials and Water

***Contents in Brief** — In a new type lavatory for theater-of-operation cantonments, waste water from wash troughs and showers is collected in a tank and used again for latrine flushing purposes. To achieve conservation of critical materials, the wash troughs and urinals are made of split, vitrified tile, and the latrine pit is made of concrete with a wooden cover*

A COMMUNAL LAVATORY in which the use of critical materials virtually is eliminated and in addition provides for the re-use of shower water for flushing purposes, has been developed by the Construction Division of the Corps of Engineers. Designed for use in theater-of-operations cantonments, experimental units have been constructed at several locations and are now undergoing tests.

Essentially the unit is a modification of the standard lavatory generally used in army cantonments to effect the elimination of all plumbing and sanitary fixtures. In lieu of toilet fixtures there has been substituted a latrine pit of concrete construction which has a wooden top with a double row of seats. A half-tile wash trough replaces the lavatories and a half-tile flushing trough is substituted for the usual type of urinal fixture.

All waste water from the wash troughs and the shower baths is collected in a dosing tank located under the dressing room floor. This water is used to flush the latrine pit and the flushing is accomplished by means of a 10-in. dosing siphon. The entire flush is conducted through the latrine pit and into the sewer. If circumstances are such that the flush tank is not filled frequently enough with waste water, provisions are made to add water to the tank directly from the plumbing supply.

Flushing of the urinal is provided by means of a 40 gal. tank or barrel in which is installed a 3-in. dosing siphon. The outlet from the urinal trough is discharged into the latrine pit.

Critical materials eliminated

The design not only provides for the dual use of water but the construction eliminates the need for more costly basin, urinal and other ceramic toilet fixtures, all of which require extensive metal piping. The unit utilizes materials of construction that are readily available on any construction project and only a few special items are required to complete the installation.

Restrictions on piping have been carried to the point where only a single feed line, carrying pre-mixed hot and cold water, serves the wash troughs. The shower room is so located in connection with the hot-water storage tank that only a minimum of piping is needed to provide adequate washing facilities.

By re-using the shower and lavatory water for flushing the latrine pit the water normally used for flushing toilet fixtures is saved. This amounts to a minimum of 10 gal. per man per day, which for a large camp represents a substantial saving. It has been found that under average conditions of army use a flushing tank holding 1,000 gal. of water, will satisfactorily flush the latrine pit and will provide a sufficient number of flushes during the day to keep the unit in a sanitary condition.

Medical officers who have observed the operation of the unit have expressed satisfaction with its operation

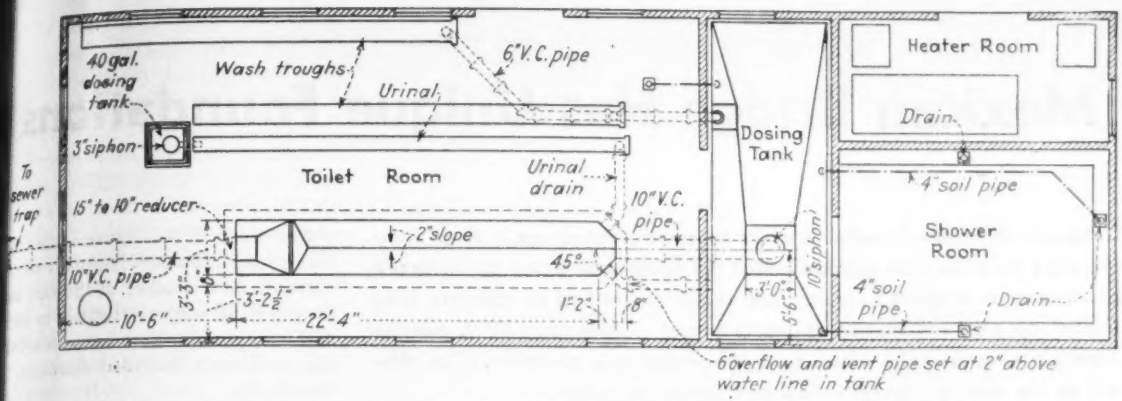


Fig. 2. General layout of the communal lavatory. All waste water from the wash troughs and shower baths is collected in a dosing tank located under the dressing room floor, and this water is re-used to flush the latrine pit.

and state that no difficulty is experienced from odors.

The general layout of the lavatory is shown in Fig. 2. It will be noted that the dosing tank is located between the shower room and the latrine, with the discharge on the centerline of the latrine. The tank is located below the floor level, and it is connected with drains laeding to the shower room floor and to the wash troughs.

On opposite sides of a longitudinal partition in the toilet room are located the wash trough and urinal. An additional wash trough is placed against an outside wall of the building.

Details of the latrine box-pit and the dosing tank are shown in Fig. 3. Here it will be noted that the sides of the latrine pit are sloped to form a V-shaped channel, at the outlet end of which a dam 6 in. in height is provided. The dam serves to impound a small amount of water in the pit at all times and thus assures that the flushing operation will scour away the solids into the sewer line.

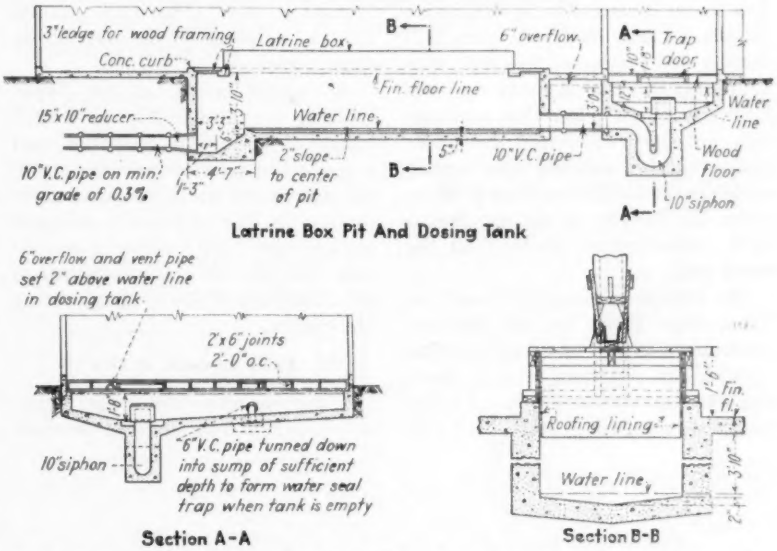

3" ledge for wood framing
Latrine box
B
6" overflow
A
Trap door
Conc. curb
Fin. floor line
Water line
15" x 10" reducer
2" slope to center of pit
10" V.C. pipe on min. grade of 0.3%
10" V.C. pipe
Wood floor
10" siphon
Latrine Box Pit And Dosing Tank
6" overflow and vent pipe set 2" above water line in dosing tank
2" x 6" joints 2'-0" o.c.
10" siphon
6" V.C. pipe tunned down into sump of sufficient depth to form water seal trap when tank is empty
Section A-A
Roofing lining
Water line
Fin. fl.
Section B-B

Fig. 3. Design details of the latrine box pit and dosing tank, which are of concrete.

Military Railway in Syria Built Along Sea Shore

A roadway of rocks and concrete blocks in deep water along the east coast of the Mediterranean Sea was built last year as part of the subgrade of a new 150-mile railway in Syria from Haifa, on the Palestine Railways, to Tripoli, a terminal point on the railway system of Turkey. This is the closing link in a standard-gage line from the Suez Canal (Egypt) to the Black Sea and the Dardanelles, and having car-ferry connection with the railways of Europe. For this new link, which was completed in December, 1942, a shore-line location was adopted for military reasons of rapid and economical construction, since a line on the high ground back of the coast would have required long high fills and many bridges.

At some places where the cliffs rise sheer out of deep water, men suspended by ropes from the boom of a crane working along the top of the cliff drilled holes for blasting down masses of rock. Another plan was to dump 100-ton concrete blocks from the tops of the cliffs, followed by others of 15 to 25 tons. When these appeared above water, concrete was filled between them to build up a stable roadbed. According to the "Railway Gazette" (London), engineer officers from the government railways of the Union of South Africa organized a construction force of 3,000 railroad men from South Africa, Australia and New Zealand, including nearly a thousand experienced in tunnel construction on the South African railways. Work was carried on 24 hours daily for seven days a week. Materials were obtained from the United States, South Africa, Turkey and India.

Mexican Bridge Has Unique Foundations

Contents in Brief—In order to avoid concreting operations in deep water, two piers for a Mexican railroad bridge are being constructed as reinforced-concrete caps supported several feet above stream bed on concrete piles. One of the piers will support the outer end of an uncommon 62-ft. movable plate girder span, which pivots on a closed box type abutment. The other will be the middle pier for a two-span continuous girder.

FOUNDATIONS for a railroad bridge now under construction in Mexico are unique because the river piers will consist of reinforced-concrete caps supported several feet above the river bed by concrete piles. This construction not only will avoid deepwater concreting, but will also save considerable concrete. The crossing is of interest also because of the uncommon 62-ft. movable span planned for the south end.

The bridge is being built over the Tancochapa River by the Mexican government as part of a large railroad construction program. It is to be a single-track structure on a line roughly paralleling the Gulf of Mexico between the town of Puerto Mexico in Vera Cruz State and the city of Campeche in the state of the same name.

A general layout of the 3-span crossing is shown in Fig. 1. Overall length of the bridge is 298 ft. and it is of plate girder construction with the middle and north end span made continuous. The structure is designed for a Cooper E-50 loading in accordance with the 1935 specifications of the American Railway Engineering Association.

Swift currents at site

At the site where the bridge is under construction the stage of the river varies some 8 ft. between low and maximum highwater. Normally severe currents do not occur at the site, but during flood stages velocities as high as 9.6 ft. per sec. have been recorded. The maximum recorded discharge is 53,000 cfs.

Below an overlying layer of silt, the river bed is firm sand and gravel overlying clayey sand. Thus a good bearing is provided. Depth of the channel where the bridge is being built is as much as 25 to 30 ft. below low water. Thus, concrete work at considerable depth below normal pool level, would have been required if concrete for the intermediate piers had been carried down to good bearing. Because of the lack of trained personnel to do such work, and the large concrete saving possible, piers of the type illustrated are planned.

Most difficult to construct will be Pier 3, which will consist of a reinforced-concrete cap supported on a total of 24 precast, heavily reinforced concrete piles of 18-in. dia. The cap

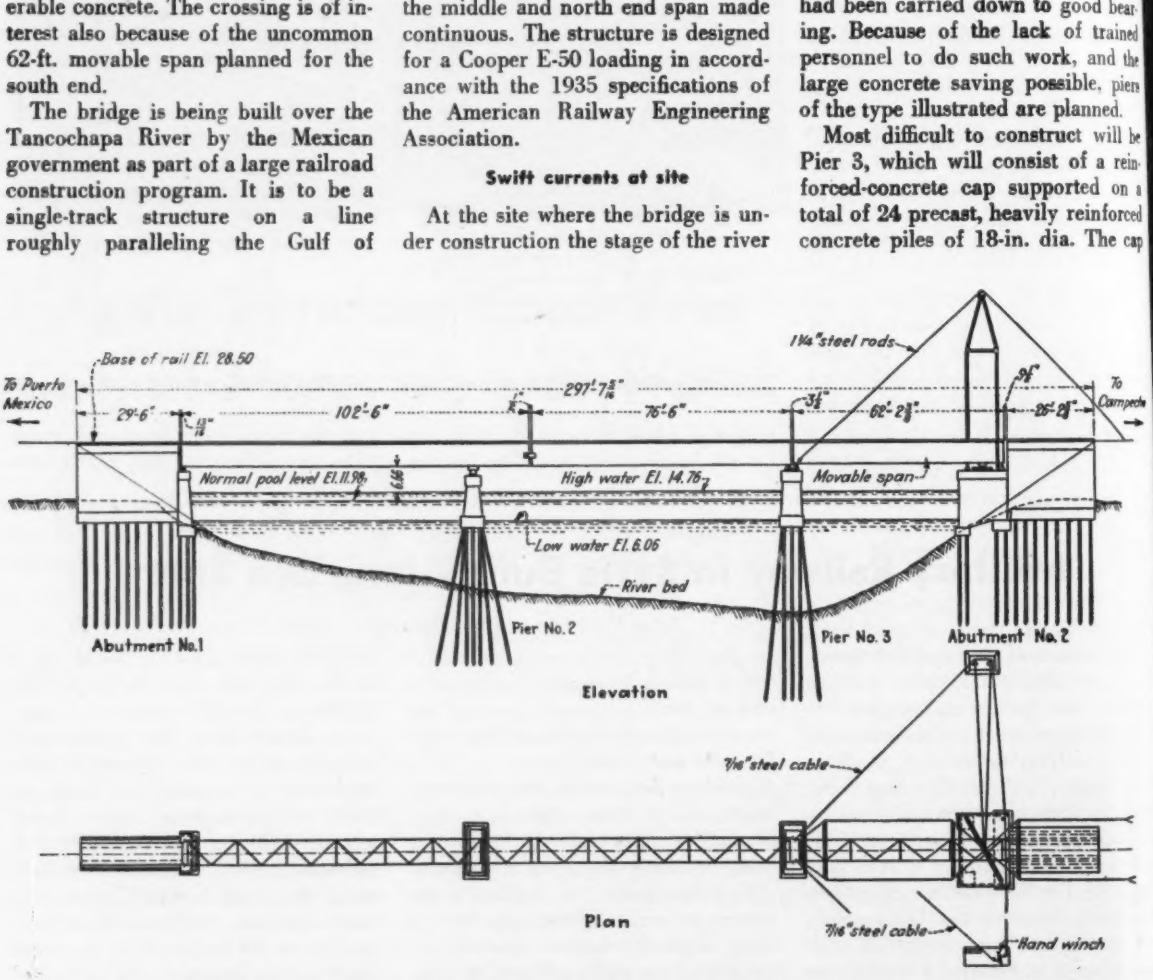


Fig. 1. This single-track railroad bridge over the Tancochapa River is notable because its piers are supported on long piles and because of its unusual swing span.

will be nearly 10 ft. thick and the top will measure 6½x12½ ft. and the bottom 11x20 ft. For this pier, exclusive of the piles, 85 cu.yd. of concrete will be required.

Because of the depth of the channel at that point about 25 ft. of the piles will be exposed to the swift current and they will be driven about 30 to 35 ft. into the stream bed. The top of the piles will be at normal low water level, but because the tops are to be embedded in the cap, the piles will not be exposed at times of low water. This arrangement will result in a pier that will appear to be a solid foundation. To provide greater rigidity of the pier, many of the piles will be driven on a batter.

Design of Pier 2 is very similar to the construction just described. The major difference is that the cap will be somewhat smaller and contain only 80 cu.yd. It will be supported on 28 of the 18-in. dia. reinforced concrete piles. As with Pier 2, the design bearing load is 22 tons per pile.

Because the river is navigable at the site where the bridge is under construction, the first span on the Campeche side is designed as a 62-ft. movable unit. It will rotate in a horizontal plane about a pivot point on the abutment, which is an unusual combination of reinforced-concrete hollow box and elevated approach section of a design uncommon to railroad work in the United States. This abutment, which is illustrated by Fig. 3, will require 140 cu.yd. of concrete.

Swing span manually operated

Operation of the movable span will be by the manually-operated winch and cable system illustrated in Fig. 1. To support the outer end of the movable span 1¼-in. ties will extend from that end over a steel-frame tower on the abutment to anchors on shore. Each column of the tower, which is 52 ft. high above the abutment, consists of two 10-in., 20-lb. channels.

The girders of the swing span are 62 ft. long and 6 ft. deep. The distance between the center of the rotation and the support at the river end is 56 ft.; when the span is closed the distance between supports is slightly less than 60 ft. The support on the river pier is a wedge brought into contact with the girders through a crank-operated worm. The support at the landward end, which is a few feet farther landward than the pivot, is of similar construction.

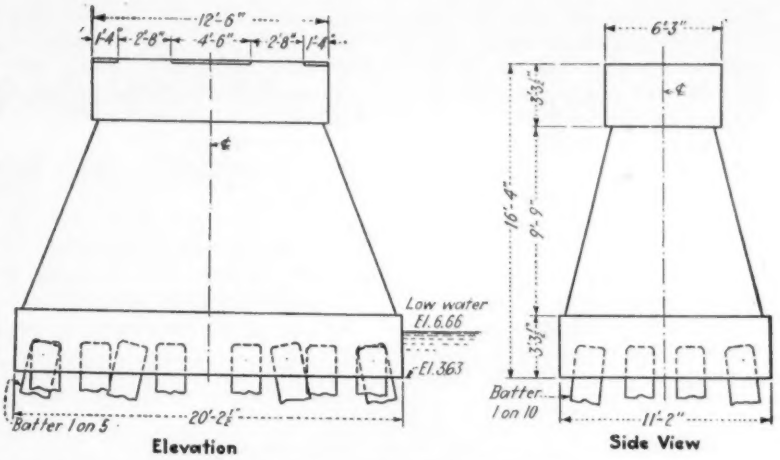


Fig. 2. Pier 3 will be a reinforced-concrete cap supported on 24 precast concrete piles of 18 in. dia. About 25 ft. of the piles will be exposed to the swift currents encountered at the site.

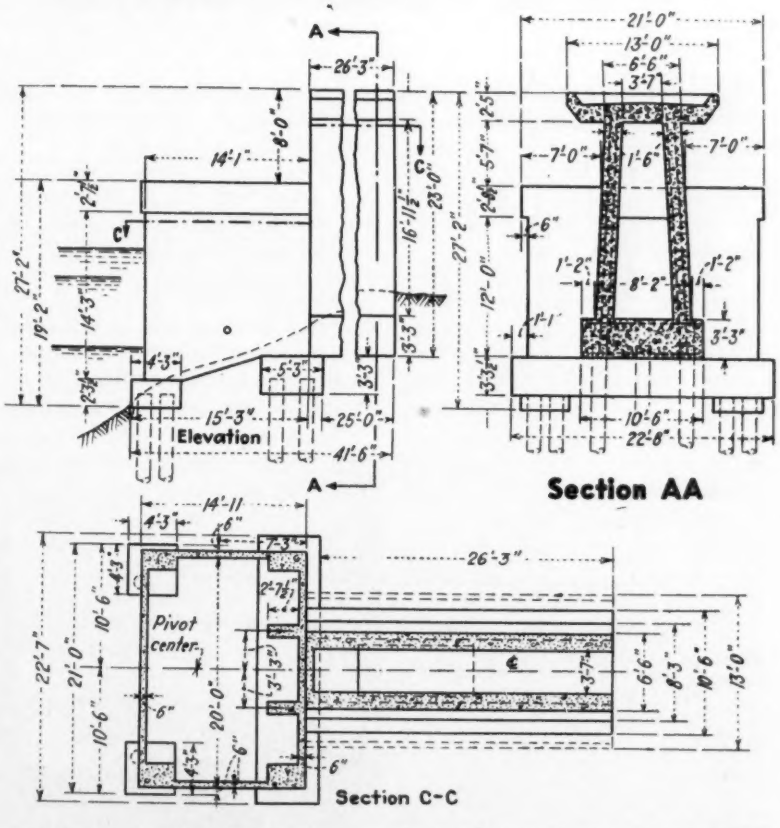


Fig. 3. To support the landward end of the 62-ft. movable span an abutment of the type above will be constructed. By making the approach of the type shown at the right, a considerable saving of concrete will be possible.

To open the bridge the wedges at both ends are loosened by hand to cause the girders to rest on the pivot of rotation and three wheels. Two of the wheels are at the landward end, one either side of the pivot, while third supports the outer end of girders at the river pier. These wheels move along steel rails. With the girder lowered onto the wheels a slight tension is placed in the lateral $\frac{7}{16}$-in. dia. steel cable extending diagonally from the far end of the girders to the hand winch shown on the abutment in Fig. 1. When the wheel at the landward end of the span runs

of the edge of the pier, the outer ends of the girders are supported by the 1¼-in. dia. steel rods running over the steel-frame tower previously mentioned. The plane of this tower is not vertical but is slightly inclined toward the quadrant in which the girders move. With this arrangement, the maximum force necessary to open the bridge comes at the start, as subsequently the weight of the girders assists the operation.

The north and middle spans are continuous, as mentioned previously, and the girders for the south span are cantilevered into the middle span 16½ ft. At the end of this cantilever a pin connection is used, which provides an expansion joint and keeps the dead loads the same in case of any pier settlement.

The abutment at the opposite end of the bridge is to be similar to the pier design just described, although it requires less concrete and reinforcing steel. Like the first abutment it will also be located on wood piles.

For designing the bridge a concrete stress of 700 psi. in compression and 40 psi. in shear was permitted. For the steel a stress of 18,000 psi. was used. For the entire project, 724 cu.yd. of concrete, including 230 cu.yd. of plain concrete, 24 tons of reinforcing steel, and 102 tons of structural steel will be needed.

The bridge is being built by the Mexican Federal Department of Railroads for which Pedro Martinez Tornel is director general. Estimated cost of the work is 350,000 pesos, which is about $70,000 in American money. Construction was started in July, 1942, and the structure was scheduled for completion March, 1943.

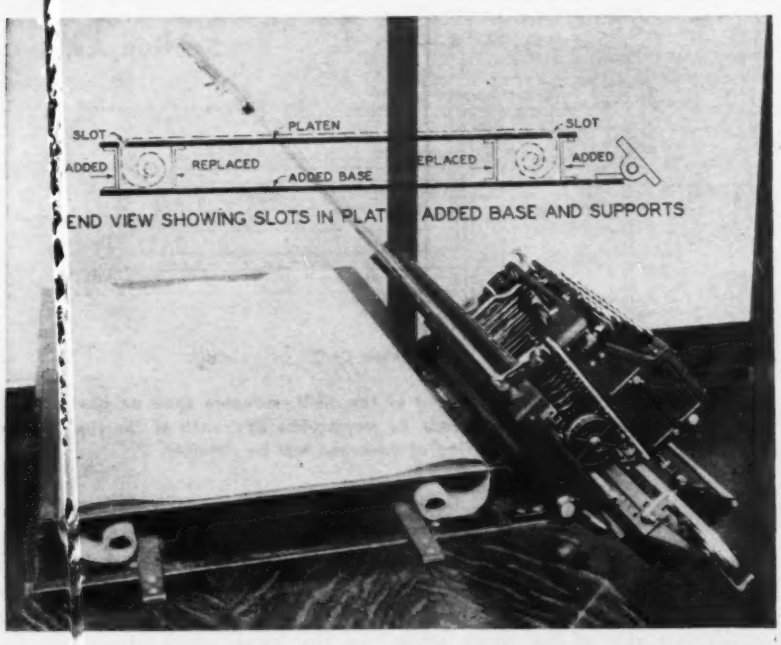
Use of Billing Machine Saves Time in Lettering Engineering Drawings

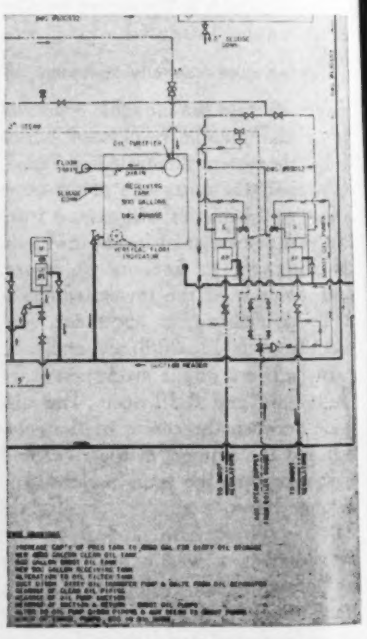
Since draftsmen trained to do fast, symmetrical free-hand lettering—the result of many years of practice—are not available for many jobs, mechanical means must be substituted whenever practical to obtain presentable and legible drawings.

One method is the use of the typewriter. A stenographer or typist may, from dictation or the draftsman's long-hand notes, do complete or partial lettering jobs on drawings. However a machine which will accommodate large drawings is not only unusually high in cost but the visible working area is very limited.

An economical means of obtaining a machine with the desired characteristics can be had by modifying an Underwood Elliott Fisher billing machine as shown by an accompanying photograph. With the machine illustrated the platen was cut into three sections and resupported from a subbase by means of spacer feet. Cutting the platen into three sections formed two slots, which allows the drawing to pass and be rolled in the space between the platen and the sub-base as illustrated. This arrangement will take any size drawing, both as to length and width, and provides for one setting a composing area 18 in. high by 16 in. wide. The tracing may be slid lengthwise or rolled vertically.

Pica Gothic type is recommended because of its clear, sharp images. Other smaller or more elaborate types tend to clog up. Also care should be taken in the choice of a ribbon, as it should not require carbon backing to obtain an opaque image but should be quick-drying to prevent smudging and be free from bleeding on the surface of the drawing. The ribbon should leave no ghost marks.





A billing machine may be altered as shown above to do much of the lettering on large drawings. Also shown is the arrangement of the platen. Right: Typical example of complete machine lettering on part of a drawing.

Strength of Nailed Plywood Joints Subjected to Lateral Loading

***Contents in Brief**—Tests to destruction with lateral loads on plywood of different thicknesses were made as a basis for tabulations of relative strength of joints using nails of various sizes. Materials and conditions of tests were made to conform closely to usual field practice and results indicate that a factor of safety of about 5 is permissible.*

DATA ON THE STRENGTH of joints through which lateral loads in plywood panels are transferred into a stud or frame to which the panels are nailed, are useful in analyzing structures that are braced with plywood. The bracing might be used, for example, in carrying end thrust caused by wind loads, in horizontal webs whose function is to resist earthquake loads or in the plywood gussets of timber trusses. In all such cases the direction of the stress puts the nails in lateral bearing both in the plywood and in the supporting frame member (hereinafter referred to as the stud). To obtain data on strength of joints of this type some 650 laboratory tests were made by the Douglas Fir Plywood Association and results were arranged in convenient tables, the more important of which are reproduced herewith.

Factors in joint strength

At the outset it was thought that the strength of the joint would depend upon the direction of the face-ply grain of the plywood with respect to the direction of the load. Careful tests on loads applied parallel, perpendicular to and at 45 deg. to the face-ply grain showed no consistent or predictable difference. Previous tests (U. S. Forest Products Laboratory) have shown no significant difference in nail bearing parallel with and perpendicular to the grain of the stud, provided, of course, that end-grain nailing is not used.

Essential factors in nailed plywood joints were found to be (1) plywood thickness; (2) nail size; (3) moisture content and specific gravity of plywood and stud; (4) plywood edge-distance (see Fig. 1 for "edge-distances") and (5) stud edge-distance.

Obviously the strength also varies with the unit strength of the wood and hence with the species of wood used. In these tests only the one species of wood, i.e., Douglas Fir, was considered. Specific gravity and moisture content were not varied systematically but in the specimens selected for test these qualities were such as are ordinarily found in commercial lumber of this species as sold to the trade. Every endeavor was made in selection of panels and studs and in carrying on the tests to follow procedure that would make the tabulated results applicable in common practice.

Method of analysis

The first objective was to find the minimum edge-distance for both plywood and stud that would develop maximum strength in a nailed joint. Tests were therefore conducted to ascertain these minimum values, which are listed as "standard edge-distances." It is to be noted (Fig. 1) that the sum of the stud edge-distance and the plywood edge-distance ordinarily equals one-half the stud thickness, when considering the framing members at the edge of the panel. The test for each of the variable values was made with the other factors amply strong so that results would be determinative for the value under investigation.

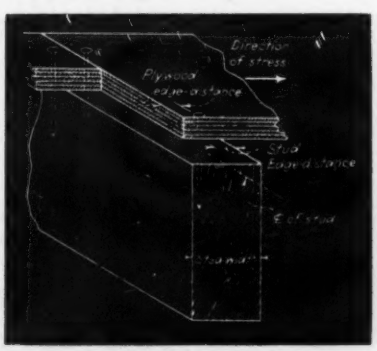


Fig. 1. Typical detail, plywood panels butted along the center line of stud. Note "plywood edge-distance" and "stud edge-distance."

The results show strength of the joints decreasing along definite curves (Fig. 2), which are plotted on a percentage basis, starting with the standard edge-distance as 100 percent. Thus, the curvature shows the effect on strength of decreasing plywood edge-distances. The actual ultimate load at the standard edge-distance, together with the standard edge-distance, are shown in the table with Fig. 2 for the combinations of nails and plywood thicknesses tested.

In the second series of tests where the procedure was reversed to evaluate the strength at various stud edge-distances (while maintaining an amply strong plywood edge-distance) the standard stud edge-distances were developed for nails of various sizes. The plywood thicknesses tested had very little effect on these values. The maximum nail bearing value developed for the studs are naturally equal to the maximum developed for the same size nail in the plywood, although the corresponding standard edge-distances differ somewhat.

In practice, where plywood is nailed to framing members, the available edge-distances are sometimes less than the standard values given in the table with Fig. 2. When this occurs ultimate loads should be correspondingly reduced. The ultimate strength of such joints will be limited by the nail bearing value either in the plywood or in the stud.

To obtain the plywood bearing value, select from the table with Fig. 2 the ultimate load at standard edge-distance for the plywood thickness and nail size contemplated. For example, using ½-in. plywood and 8 d. common nails, if this value is 470 lb. at an edge-distance of ⅝ in. and if nails are to be driven ¾ in. from the

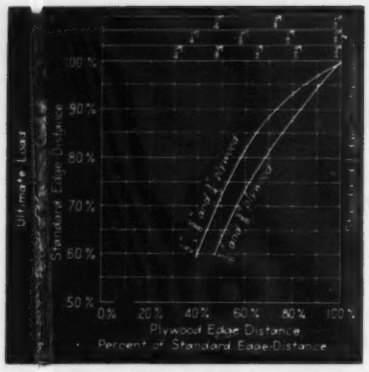


Fig. 2. Effect of varying plywood edge-distances on ultimate load capacity.

plywood edge, the edge-distance is 60 percent of the standard and the ultimate bearing value is 82 percent of that for the $\frac{3}{4}$-in. standard or 82 percent of 470 which is 385 lb. per nail.

This value should now be compared with the bearing value of the nail in the stud. From Fig. 3 it is seen that an 8 d. nail with $\frac{7}{16}$-in. stud edge-distance (which corresponds to the $\frac{3}{4}$-in. plywood edge-distance as shown in Fig. 1) has a bearing value of 349 lb. This will govern since it is less than the plywood bearing value of 385 lb.

For more precise design the optimum value may be obtained by a cut and try process. A slight increase in the stud distance to $\frac{1}{2}$ in. and a consequent decrease in the plywood edge-distance to $\frac{5}{16}$ in. would result in a value of 385 lb. for the stud and 71½ percent of 470 or 335 lb. for the plywood which would be lower than before. The optimum theoretical value will be found to be 365 lb. at $\frac{1}{32}$-in. edge-distance in the plywood and $\frac{1}{32}$ in. for the stud. In making the tabulation it was not thought desirable to consider measurements closer than $\frac{1}{16}$ of an inch.

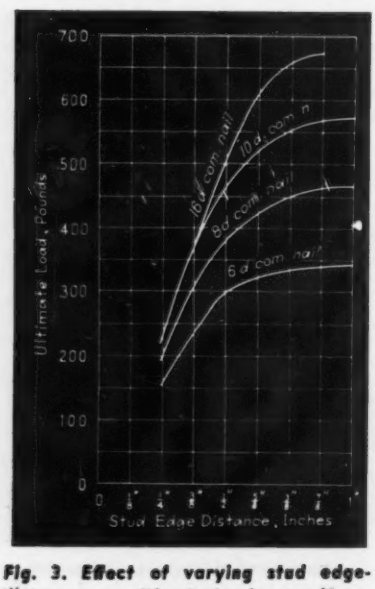


Fig. 3. Effect of varying stud edge-distances on ultimate load capacity.

TABLE FOR FIG. 2—ULTIMATE LOADS FOR STANDARD PLYWOOD EDGE-DISTANCES

	Nail Sizes							
	6 d. Com.		8 d. Com.		10 d. Com.		16 d. Com.	
Plywood Thickness (in.)	Load (lb.)	Standard Edge-Distance (in.)	Load (lb.)	Standard Edge-Distance (in.)	Load (lb.)	Standard Edge-Distance (in.)	Load (lb.)	Standard Edge-Distance (in.)
5/16	335	1/2	420	5/8				
3/8	345	1/2	470	5/8				
1/2			470	5/8	500	1/2		
5/8			470	5/8	575	5/8	630	5/8
3/4					575	3/4	675	3/4

(Use the scale at top of Fig. 2 whose standard edge-distance corresponds to nail size and panel thickness given in the table.)

Working loads and safety factors

Tables I and II give ultimate loads for plywood butt-jointed on the center line of 1$\frac{5}{8}$-in. and 2$\frac{5}{8}$-in. studs. The edge-distances have been chosen so that maximum joint strength will result and any deviation from these values will result in weaker joints.

Modification of ultimate strength to arrive at safe loads should take several factors into account. The more important of these are as follows:

Loads applied to nailed joints were found to cause deformation at a varying rate. No true proportional limit was found but rather a region in which there is a marked increase in the rate of deformation with respect to the load. This region is about 25 or 30 percent of the ultimate load and was called the proportional limit. Working loads in excess of the proportional limit were found likely to cause excessive deformation.

Nailing properties of Douglas Fir were found to have a variation of about 25 percent both above and below the average. Hence, it was considered desirable to reduce the average ultimate load by 25 percent. The effect of seasoning on nailed joints (as compared to specimens tested immediately after nailing) also reduces their ultimate strength by varying amounts too uncertain to permit exact evaluation. However, a series of tests suggested that a further reduction of 25 percent for seasoning would be adequate.

The length of time during which the load is applied to the nailed joint may affect its ultimate load capacity in the same way that it affects the strength of a wooden beam. When applied for several years rupture can be expected under a load of $\frac{9}{16}$, the which would cause failure when applied in a few moments as in the usual test. Therefore, a factor of $\frac{1}{2}$ is suggested for ultimate nail load

TABLE I—MAXIMUM ULTIMATE LOADS FOR PANELS: BUTT-JOINTED ON CENTER LINE OF 1⅝-IN. DOUGAS-FIR STUDS

	Nail Sizes							
	6 d. Com.		8 d. Com.		10 d. Com.		16 d. Com.	
Plywood Thickness	Load	Plywood Edge-Distance	Load	Plywood Edge-Distance	Load	Plywood Edge-Distance	Load	Plywood Edge-Distance
5/16	275	3/8	306	3/8				
3/8	275	3/8	342	3/8				
1/2			349	3/8	425	3/8		
5/8			349	3/8	425	3/8	443	3/8
3/4					412	3/8	443	3/8

TABLE II—MAXIMUM ULTIMATE LOADS FOR PANELS: BUTT-JOINTED ON CENTER LINE OF 2⅝-IN. DOUGLAS-FIR STUDS

	Nail Sizes							
	6 d. Com.		8 d. Com.		10 d. Com.		16 d. Com.	
Plywood Thickness	Load	Plywood Edge-Distance	Load	Plywood Edge-Distance	Load	Plywood Edge-Distance	Load	Plywood Edge-Distance
5/16	335	1/2	420	5/8				
3/8	339	1/2	443	9/16				
1/2			453	9/16	500	5/8		
5/8			453	9/16	555	9/16	620	5/8
3/4					541	5/8	640	5/8

the basis of any long-time loading. Where repetition of load and reversal of stress is to be involved, allowance also should be made for these elements.

A single numerical factor can be used to allow for some or all of these safety factor reductions. A factor of safety of 5 or about one-fifth of the ultimate loads listed in these tabulations gives values in close agreement with working loads recommended by the Pacific Coast Uniform Building Code for Douglas Fir.

The tabulated values can be interpolated for other nail sizes, should this be desirable, by making use of the data developed by the United States Forest Products Laboratory, which finds that the lateral bearing strength of nails is proportional to the 3/2 power of the nail diameter. The tables may be applied to studs other than Douglas Fir by a comparison of the two woods as listed on page 123 of the Forest Products Laboratory's "Wood Handbook."

The tests were conducted recently in the laboratory of the Douglas Fir Plywood Association, Tacoma, Wash., under direction of David Countryman, author of a forthcoming report from which the foregoing has been taken.

Sanitary Engineers Assume Important Role in War

A shortage of sanitary engineers has made it necessary for the War Manpower Commission to establish a procurement and assignment service. The functions and objectives of this service are outlined by Capt. C. W. Klassen of the Sanitary Corps in the following, which is an extract of a talk given recently before the Illinois Section of the American Waterworks Association.

SANITARY ENGINEERS TRAINED to recognize and control environmental conditions that may cause diseases, have always been limited in number. The present critical shortage of trained sanitary engineers has been brought about by the needs of the armed forces for the services of such men in all parts of the globe to help protect our troops against many of the diseases transmittable through improper sanitation and insects that may exist in those localities.

Already this has necessitated a large withdrawal of trained personnel particularly from many of the state and local health agencies and from local water and sewerage departments. But, the military needs for such personnel have not yet been fully satisfied. Therefore, the War Manpower Commission is confronted with the problem of making the best use of the dwindling number of persons trained in sanitary engineering for military, semi-military and civilian purposes.

In order to assure sufficient trained personnel to maintain these necessary levels of health protection through sanitation, a new Procurement and Assignment Service for Sanitary Engineers has been engaged in three principal functions: (a) Determining the military and civilian needs for sanitary engineering personnel for this country and abroad; (b) estimating the availability of sanitary engineering personnel of various ages and grades of experience; (c) establishing a plan for a well-balanced allocation of such persons in so far as practicable to meet required civilian and military needs.

The needs for trained personnel in the armed forces covers a wide field in order to cope with the control of environmental problems, many of which are peculiar to the areas where our fighting forces are located. These include new problems in water supply protection and treatment as well as insect-borne diseases such as malaria, yellow fever, filariasis, dengue, typhus and others.

Where engineers are needed

In this country many of the health problems encountered in the past among the civilian population and with which we are familiar, are also those of the armed forces. Likewise in foreign lands, the disease hazards of the native population of an area where troops are located naturally becomes important to the armed forces. Problems previously known to us only through references or literature now have become real.

Wherever troops go, whether it be to a college or camp for training or to a theater-of-operations for combat, health protection through sanitation must be adequate. Thus we find trained personnel needed for malaria control units, for design, construction and operation of water supply and sewerage facilities and for service in connection with the army medical department activities in the inspection, recommendation and supervision of the sanitary quality of water.

Sanitary engineers are needed for all of the army's divisions and task forces. And sanitary engineers are included in the plan for the military government units that will operate in occupied areas. Later such engineers will also be necessary in the foreign relief and rehabilitation programs in such areas. The Corps of Engineers needs personnel for the operation of its water and sewerage utilities. Likewise, semi-military needs, primarily those of the United States Public Health Service, include personnel for malaria control in important war areas in this country, for industrial hygiene problems in the war industries, for general sanitation work in the state and local areas, in addition to the need for men for foreign service in the Pan-American Sanitary Bureau, in Hawaii on general sanitation, and in Alaska.

The number of trained sanitary engineers needed for the armed forces in this country and abroad for the coming year are now known. In determining the civilian needs, it will be necessary that the civilian use of such trained sanitation personnel be based upon the essentiality of the particular position, as it relates to the war effort. Some civilian sanitation activities not directly related to the war, but considered necessary during peacetime, may have to be

materially curtailed, dependent upon the available supply of trained personnel for civilian uses.

In this connection, the Procurement and Assignment Service is keeping in mind that probably all of the trained personnel in this field below the age of 38 years that are physically fit for military duty will be utilized in the armed forces. Thus it must be anticipated that a further withdrawal of such men from their civilian positions is probable.

It becomes necessary, therefore, that no time be lost in training persons (both men and women) who are not qualified for military service, to replace these younger men. Already a plan is under way in the public health field to replace these younger, trained men, by persons in the older age group after they have been given proper instruction and training. Similar plans are contemplated for a replacement training program in other fields of sanitation, such as in the operation of water and sewerage facilities.

To determine the availability of persons trained to meet all of these military, semi-military and civilian sanitation needs including those suitable for replacement training, a roster is being rapidly developed and the qualifications of persons are being reviewed to determine where they best may serve. Qualifications are outlined as follows:

> "For the purposes of the Procurement and Assignment Service of the War Manpower Commission, the professional occupational designation "sanitary engineer" shall apply to a graduate of an approved scientific engineering school* (1) who is designated a sanitary or public health engineer by a state, county, or municipal health department in which he is employed; or (2) who has fitted himself by suitable training, or study, and by experience to conceive, design, construct, operate, direct, and manage engineering works developed, as a whole or in part, (2) for the protection and promotion of the public health or (b) capable of injuring the public health."
>
> (*In exceptional circumstances, eight years of suitable experience and study that give evidence of the acquisition of proficiency in the fundamental engineering sciences as well as in engineering technique may be considered equivalent to graduation from an approved engineering school.

"Ability to identify, evaluate, and explain, in terms of their sanitary or public health implications, those factors connected with engineering works that will prevent injury to health or that will promote health, in addition to ability to conceive, design, construct, operate, direct, and manage such works shall constitute the basis of differentiation between individuals qualified as sanitary engineers and individuals qualified only as civil, mechanical, electrical, mining, or chemical engineers."

Based upon the training, experience of an individual, he will fall into one or more of the following classes: (1) Public health; (2) design and construction of water, sewerage and drainage facilities; (3) management and operation of water and sewerage facilities; (4) industrial hygiene; and (5) teaching or miscellaneous.

Anyone coming within the scope of this definition is requested to place his name with the War Manpower Commission and for any further information, communicate with the Procurement and Assignment Service, War Manpower Commission, 1006 U St., Washington, D. C.

Manpower and Materials Shortage Hampers Municipal Public Works

Shortage of manpower, inability to obtain street repair materials and scarcity of equipment repair parts head the list of problems besetting the operation of public works services in the nation's cities, a recent survey of 90 cities of more than 10,000 population shows.

Highlights of the report on the survey, made by the American Public Works Association, are listed as follows:

1. Approximately 47 per cent of the cities reporting indicated that loss of manpower was felt in such activities as refuse collection, street repair, street cleaning, snow removal, and in the operation of sewage and water supply facilities.

2. Lack of asphalt and tar products for street maintenance and repair is becoming acute, with a third of the cities reporting a definite need for these materials.

3. Urgent need for repair parts for automotive as well as stationary mechanical equipment was reported by nearly a third of the municipalities. Repair parts for refuse collection and street cleaning trucks, for sewerage and water supply pumps, fibre and steel gutter broom wire for street sweeper equipment, and replacements for street repair equipment in general are urgently needed at the present time.

How problems are being overcome

A number of cities are overcoming inability to obtain additional automotive equipment, the association said, by working available trucks for longer periods of time. Detroit, for example, has adopted the six-day week, which should tend to alleviate the shortage of hired trucks. Semi-weekly garbage collections in Detroit may be reduced, however, unless additional trucks become available for hire in the future.

Purchase of secondhand equipment has relieved the situation in a number of cities, Washington, D. C., reporting that used trucks are filling a great need for additional equipment in the city refuse division.

About 24 per cent of the cities surveyed need replacement for automotive equipment.

One out of every six of the cities indicated need for garbage cans or collection baskets, with 25 of the cities reporting that miscellaneous shortages are inconveniencing the provision of essential municipal services.

Listed as "needs" by the 90 cities for continuance of necessary public works services in the future were the following items: Common nails, portland cement, traffic paint, fire hydrants, manhole covers and other castings, reenforcing steel, rubber hose, lumber and bridge timber building hardware, tarpaulins, plumbing and electrical supplies, welding rods, valves, water meter parts, reenforced concrete pipes, and a number of building repair materials made of brass, iron, copper and other critical metals.

Despite the shortage, however, public works departments are attempting to maintain a normal level of service by making adjustments when necessary. Thirty-one of the 90 cities indicated their public works services of an essential nature are not hampered to a noticeable degree at this time.

Railroad Bridge Salvaged for Highway Use

C. A. Rothrock
Assistant State Construction Engineer, State Road Commission of West Virginia

UTILIZATION of a part of the steel superstructure of an old railroad bridge in construction of a 51-ft. highway crossing is the chief feature of a contract recently awarded by the State Road Commission of West Virginia. A saving of 43 tons of reinforcing steel will result.

The new bridge is to be constructed over Hurricane Creek on Route US 60 in Putnam County as part of a relocation project. When the relocation was first planned, a reinforced-concrete bridge was contemplated and the design was made based on the use of three 35-ft. deck-girder spans placed on a substructure of two reinforced-concrete piers and two "spill-through" abutments. The roadway was to consist of two 24-ft. lanes separated by a 4-ft. median strip, plus a 3-ft. sidewalk on each side. This design would have required the use of 43 tons of reinforcing steel.

Because the project involved a large amount of heavy excavation and concrete paving that would require more time than was necessary for construction of the bridge, a contract was awarded for this work before the bridge plans were completed. After the grading was under way it was realized that construction of the bridge on the original plan would be impossible because of the steel requirements. Following recommendations of the Public Roads Administration, an investigation was made as to how the highway crossing could be completed without additional steel.

The investigation revealed that there was an old railroad bridge for sale in Pocahontas County. The crossing was on an abandoned logging railroad and spanned the Greenbrier River at Spice Run Station, which was about 150 miles from the highway project. Examination of the old structure revealed that it included four steel girder spans adaptable for use in a highway bridge. Each of the four spans consists of a pair of plate girders of a depth of 4 ft. 6 in. They are spaced 6 ft. 6 in. c to c and joined by crossbracing.

Accordingly, a new design was made for a highway crossing with a temporary superstructure. The new design, which is for an H15-S12 loading, requires that the four spans be placed on gravity-type abutments to support an 8-in. laminated wood floor covered with a 2-in. bituminous surface. Timber hand rails are to be used.

Narrow temporary roadway

The design of the temporary superstructure calls for a roadway width of only 30 ft. 8 in., without sidewalks, but the abutments are being constructed full width to accommodate a future roadway widening to four lanes with median strip as originally planned. In the highway bridge with the temporary roadway, the four pairs will be used as shown by Fig. 1. With this arrangement the bracing for a 6-ft. 6-in. spacing could be utilized and no new bracing required.

The plans also provide for future widening of the bridge deck and this work is expected to be undertaken as a postwar project. With this construction the distance between adjacent girders will be increased from 1 ft. 7 in. to 8 ft. 8 in. The wooden floor will be replaced with a concrete slab and on each side will be added a 3-ft. sidewalk and a concrete railing. Thus, the final roadway width will be two 24-ft. lanes separated by a 4-ft. median strip.

Construction of the abutments is now under way, having been contracted for by supplemental agreement with the Gilbert Construction Co., the general contractor for the grading and paving contract. A contract for dismantling the railroad bridge, transporting it to the new site, and construction of the temporary deck was recently awarded to the Pocahontas Construction Co.

The project is being financed by the West Virginia State Road Commission, using federal-aid funds. The Public Roads Administration is represented by William Brewster, senior highway engineer, and J. C. Cobb, highway engineer. The new structure was designed by the West Virginia State Road Commission, M. L. O'Neale, chief engineer; George W. McAlpin, state construction engineer; L. L. Jemison, bridge engineer, and Howard A. Levering, resident engineer in charge of construction.

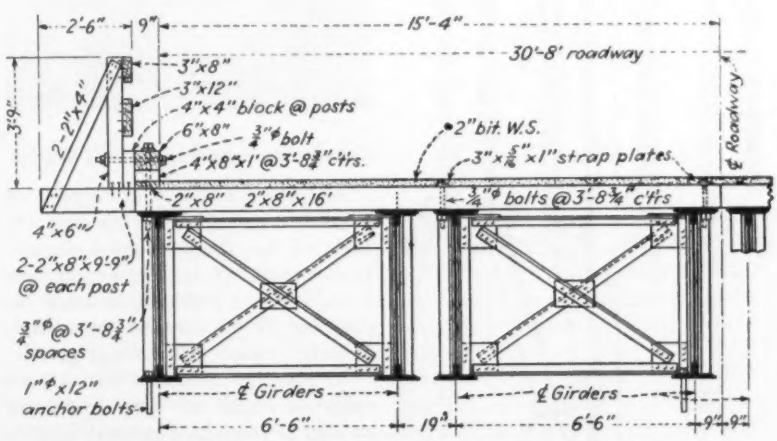


Fig. 1. Half section through the temporary highway crossing. Later the 1 ft. 7 in. dimension between girders will be increased to 8 ft. 8 in., the timber deck replaced with a concrete slab, and a 3-ft. sidewalk added on each side.

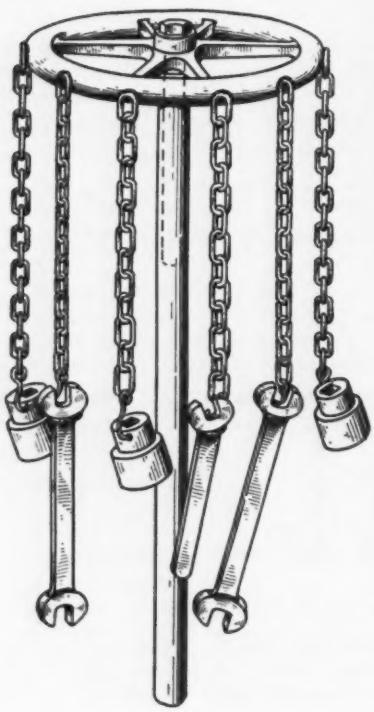
From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTO

Handy Maintenance Tool Rack

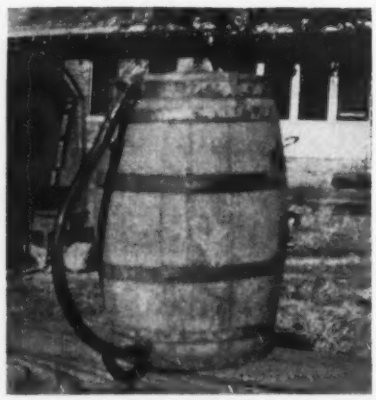
Pumps, boilers and other equipment used on a construction job requiring servicing cannot be sent to the shop for repairs, but must be overhauled on the spot and with least possible delay. To prevent loss of tools and damaged equipment in making such repairs, one contractor devised a revolving rack that speeded up tool selection, enabled a quick survey to determine the condition of each unit, and as a result maintenance cost was reduced far more than the cost of the tool rack.

A gate-valve wheel, mounted on a 1½-in. pipe stub to turn freely within a 2-in. pipe support, was fitted with short chains, welded at intervals around the rim. Each chain terminated in a hook, made from ½-in. rod, which either fitted around a wrench shank, or could be passed through an opening in the socket shank. Such a support permits the wrenches to be "hosed down" or washed with gasoline without involving other equipment.—*Charles C. Lynde, P. O. Box 1129, Houston, Tex.*



"Small Parts" Box for Steel Work

Steel boxes into which can be dumped parts or materials for use in the plate shop of Marinship Corp., in California, are provided in each of the seven bays of the large plate shop building. The boxes are welded, using material found in the salvage yard and have ears on opposite ends for convenient handling by the overhead cranes.



Job-Made Fountain Saves Water

Increasing difficulty in keeping on hand a supply of drinking cups for each of his truck-mounted maintenance crews, led one Texas contractor to substitute a job-made fountain for the cups. To his surprise, the amount of water wasted was reduced greatly.

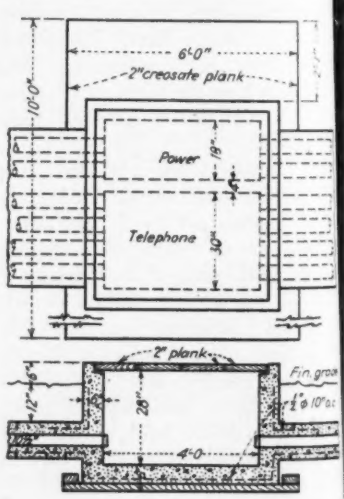
In place of the usual barrel with spigot a length of ½-in. hose long enough to reach in a gradual bend to the top of the container was attached to the barrel. At the upper end of the hose was affixed a bubbler or drinking fountain with a handle for holding and a single jet opening in the center.

To use the fountain it is simply unhooked and lowered until the force of gravity gives the desired height of jet. Shutting off the flow is likewise simplified, as the mere hanging up of the fixture raises the outlet above the water level within the barrel, thus avoiding waste.—*Charles C. Lynde, Box 1129, Houston, Tex.*

Conduits Across Swamp

Faced with the necessity of carrying a bank of six 4-in. diam. fiber ducts for power and telephone lines across a deep peat bog, engineers of the Navy's Bureau of Yards and Docks found that the usual scheme of arranging the conduits in as compact a group as possible and encasing them in concrete created too high a bearing pressure. The solution was to spread them out in a single wide tier, as shown in the accompanying sketch.

Usually plain concrete is used for encasement, but in this case ½-in. diam. rods were placed in the bottom to afford some reinforcement. These rods were also made continuous across the pull boxes or manholes so the entire construction would be tied together and settle evenly. The increased weight at the pull boxes was distributed over the low-bearing strip by mats of creosoted plank.



Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Fluids in Motion

HANICS OF FLUIDS—By Glenn Murphy. 9 pp. International Textbook Co., ranton, Pa. $3.25.

he author states that this book written to serve as a text in the hing of an introductory course he subject of fluids. His presenta- is unusually attractive in that it s a clear picture of the nature of phenomena involved with the help not too difficult mathematical tment. The chapters on fluids at buoyant forces, uniform and -uniform flow are excellent. Those dynamics are, perhaps, too chy; this comment applies par- larly to the articles on turbines on water-hammer. The illustra- problems given with each chapter well chosen and add to the clari- tion of the principles discussed in text.

he practising civil engineer will it worthwhile to have this book his library shelf.—*Reviewed by* ENE E. HALMOS, *Consulting Engi- r, New York.*

Economy and Profit

INTRODUCTION TO THE ECONOMICS OF IL ENGINEERING—By James K. Finch. olumbia University, New York. $1.

rofessor Finch's introductory text civil engineering economics is ally commendable because of its tment of its important theme and cause of its style. In compact and erally pointed and pertinent dis- sion it presents a series of case udies of cost calculations, together th some calculations of returns. e clinical subjects range from m proportions to bridge-span ar- ngement, selection of flood-control mbinations, aqueduct layout and ffic forecasting. It may be recom- nded without reserve to young and engineers alike. The young will it an essential instruction on und cost-and-benefit accounting. ile the older men should value not the various reminders of exem- ry method but no less the fre- nt insistence on sound principles economic comparison.

Procedure of computation is perhaps over-emphasized by the author, for in spite of the above statement the reviewer believes that even fuller discussion of principles would have been useful. To take a single point: The amount of procedural detail tends to obscure the fact that revenue estimates are after all forecasts, affected with all the uncertainty of prediction from more or less reasonable assumptions. In the discussion of beam proportions the student is properly told that the calculated "economic" fish-belly shape is not in fact the most advantageous, but in reading of traffic estimates he is likely to come away with the belief that the computed result is an exact guide.

Analysis of differences in service between alternate designs or plans also may deserve more emphasis than given in the book. Many comparative plans or design alternates are not strictly comparable as to service rendered, and require study of both sides of the account.

To venture one further comment: The section on public-works economics is disappointing, being confined to a brief statement of philosophic generalities that can mean but little to the young student. The present-day importance of the subject would warrant a more determined effort to set forth some guiding considerations—including some that are ignored more or less widely in public-works construction.

However, even as it is the section will prove of value in giving the young engineer a stimulus toward doing his own thinking on the subject. If he is unusually keen he may be led to realize that some special economic problems, such as cost allocation, often become prominent in this field. His reflections on public-works revenues may also lead him to suspect that in private as well as public undertakings the time-honored practice of charging what the traffic will bear is not always sound doctrine, and that the social responsibility attaching to all construction is not measured solely by predicted corporate balance sheets.

Such comment should not obscure the fact that in the reviewer's opinion Professor Finch has done an excellent piece of work, one that adds substantially to the literature of the subject. In fact, when the present little book goes into further editions it deserves to bear the title-page note "Revised and Greatly Enlarged." If by that time some bold reformer—perhaps Professor Finch himself—has scrapped the name "engineering economics" and replaced it by a more defining name, the subject of keeping book on the debits and credits attaching to the civil engineer's works may achieve the popularity it deserves.—*Reviewed by* F. E. SCHMITT, *U. S. Bureau of Reclamation, Denver, Col.*

Alone in Its Field

PHOTOGRAMMETRY—By H. O. Sharp. 129 pp. John Wiley & Sons, New York; Chapman & Hall, London. $3.50.

To Prof. H. O. Sharp of Rensselaer Polytechnic Institute belongs the distinction of writing what is probably the first American text book on photogrammetry. The recent appearance of his book is indeed very timely, when military operations are depending upon maps and when map-makers are directing their attention almost exclusively to photogrammetric methods.

It is true that several other highly commendable publications on photogrammetry have been produced within the last few years. Practically all of these, however, belong in either one or the other of two classifications; some are of reference or handbook nature, consisting of extensive assemblies of information on all phases of photogrammetry, while others are essentially expositions of methods or results of research in special phases of the subject. Professor Sharp's new book belongs in neither of these two categories. It is purely a pedagogical treatise written by an eminent teacher, and as such this text stands virtually alone in its field.

The merits of such a text doubtless depend largely upon the actual content, upon the arrangement of the material, and upon the efficacy of the book in imparting principles, ideas, and technique to student readers. The material contained in Professor Sharp's book has been carefully chosen after his discussions with a large number of surveying teachers from many engineering schools, and

after his consultation with many eminent photogrammetrists. Nearly all of the instruments and methods which have been successfully employed in photogrammetric mapping and photogrammetric surveying, both terrestrial and aerial, are mentioned, and many are fully described; the principles of atereoscopic measuring, and in fact all of the fundamental principles underlying the various mapping processes, are carefully explained; and for several of the more teachable methods the actual technical procedure is shown in detail. All this material has been arranged for coherent presentation to classes in surveying. With the aid of numerous well chosen illustrations and geometric figures, Professor Sharp's exposition makes the subject both interesting and understandable. This work unquestionably constitutes a text of great practical value.

Possibly some surveying teachers may criticize the arrangement of certain portions of the book, but such criticism must be made with due regard to the fact that the author has had considerable experience in lecture-room and class-room presentation of his subject. Some experts in certain specialized fields of photogrammetry may question certain steps in technique recommended, or may criticize the emphasis which has been given to certain phases of the subject. Some may even dispute certain statements in the book. For example, expert operators of the multiple-projector may question the limit of precision that Professor Sharp has ascribed to the instrument, a figure that was doubtless correct for the multiplex-projector as it was originally designed. However, such criticisms of specific details, which are bound to arise regarding any text, are comparatively unimportant.

The important point is that at last a text book has been produced which can be used to advantage in presenting to surveying classes in engineering schools the fundamental principles of photogrammetry. This book points the way to teachers who may be somewhat unfamiliar with this comparatively new subject, and at the same time presents the subject in a manner that adapts the book well to student use. Professor Sharp is indeed a pioneer in this field and deserves much credit for his work.—*Reviewed by* EARL CHURCH, *professor of photogrammetry, Syracuse University.*

New Engineering Books

ENGLISH FOR ENGINEERS—Fourth Edition. By S. A. Harbarger, Anne B. Whitmer, and Robert Price. 226 pp. McGraw-Hill Book Co., Inc., New York and London. $1.75.

MECHANICAL WORLD YEAR BOOK: 1943—260 pp. Emmott & Company, 78 Palatine Rd., Manchester, England. 2s.6d.

STREAM FLOW—By Nathan C. Grover and Arthur W. Harrington. 363 pp. John Wiley & Sons, New York and Chapman & Hall, London. $4.

HEATING VENTILATING AIRCONDITIONING GUIDE: 1943—1160 pp. American Society of Heating and Ventilating Engineers, 33 W. 39th St., New York. $5.

AMERICAN SOCIETY FOR TESTING MATERIALS—Proceedings of the 45th Annual Meeting. Vol. 42. 1,217 pp. American Society for Testing Materials, Philadelphia.

AN INTRODUCTION TO ARCHITECTURAL DRAWING—Second edition. By Wooster Bard Field. 245 pp. McGraw-Hill Book Co., Inc., New York & London. $3.

CAMOUFLAGE SIMPLIFIED—By Eric Sloane. 60 pp. The Deven-Adair Co., New York. $2.50.

Reports and Pamphlets

MECHANICS OF RENEGOTIATION—By Carman G. Blough. A reprint from the *Journal of Accountancy*, 13 East 41 St., New York.

SOME FUNDAMENTALS OF TIMBER DESIGN—By Howard J. Hansen. Bulletin No. 66. Texas Engineering Experiment Station, College Station, Texas.

SOLUTION OF TWO-SPAN CONTINUOUS BEAMS UNDER LIVE LOADS BY USE OF MONOGRAPHS—By A. A. Jakkula. Bulletin No. 64. Texas Engineering Experiment Station, College Station, Texas.

WORK OF THE PUBLIC ROADS ADMINISTRATION 1942 — Superintendent of Documents, Washington, D. C. 10c.

THE USE OF CURRENT METERS IN MEASURING PIPE DISCHARGES—By Carl Rohwer. Colorado Agricultural Experiment Station, Colorado State College, Fort Collins.

MISSISSIPPI RIVER FLOOD-CONTROL MODEL—Experiment Station Hydraulics Bulletin No. 1. U. S. Waterways Experiment Station, Vicksburg, Miss.

INDEX TO A. S. T. M. STANDARDS—American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pa.

ELEVATOR WIRE ROPE MAINTENANCE—Superintendent of Documents, Washington, D. C. 5c.

A. S. T. M. STANDARDS ON PAINT, V... NISH, LACQUER, AND RELATED PRODU... —American Society for Testing Ma... als, 260 S. Broad St., Philadelphia. Single copies, $2.25.

REPORT OF THE SUFFOLK COUNTY M... QUITO EXTERMINATION COMMISSIO... Yaphank, Long Island, N. Y.

SASKATCHEWAN, CANADA—Annual re... of the Department of Highways ... Transportation.

CITY OF TORONTO—Annual report of ... Assessment Commissioner 1942.

THE POSTWAR HIGHWAY PROGRAM—Am... ican Road Builders' Association, In... national Building, Washington, D. C.

REDESIGN OF THE QUEBEC BRIDGE—Repr... from the February, 1943, issue of *Ro... and Bridges*, Toronto, Ont., Canada.

WATER TREATMENT WITH LIMESTONE—... gineering Experiment Station Series ... 65. College Station, Texas.

WARTIME ROAD PROBLEMS—No. 5: Gra... ular Stabilized Roads. Highway Resear... Board, 2101 Constitution Ave., Wa... ington, D. C.

HANDBOOK ON EDUCATION AND THE WA... Based on the Proceedings of the N... tional Institute of Education and W... Aug. 28-31, 1942. Superintendent ... Documents, Washington, D. C. 55c.

NOTES ON RESERVOIR SILTING AND SU... PENDED-LOAD MEASUREMENTS IN WAS... INGTON—By L. C. Gottschalk. Sedime... tation Section, Office of Research, S... Conservation Service, Washington, D. ...

FIRE EXPOSURE TESTS OF FIRE WINDOWS... Underwriters' Laboratories, Inc., 207 ... Ohio St., Chicago, New York, and San... Francisco.

PUBLIC HEALTH SERVICE DRINKING WATE... STANDARDS and MANUAL OF RECOM... MENDED WATER SANITATION PRACTICE... Reprint No. 2440 from the Public Healt... Reports, United States Public Healt... Service, Washington, D. C.

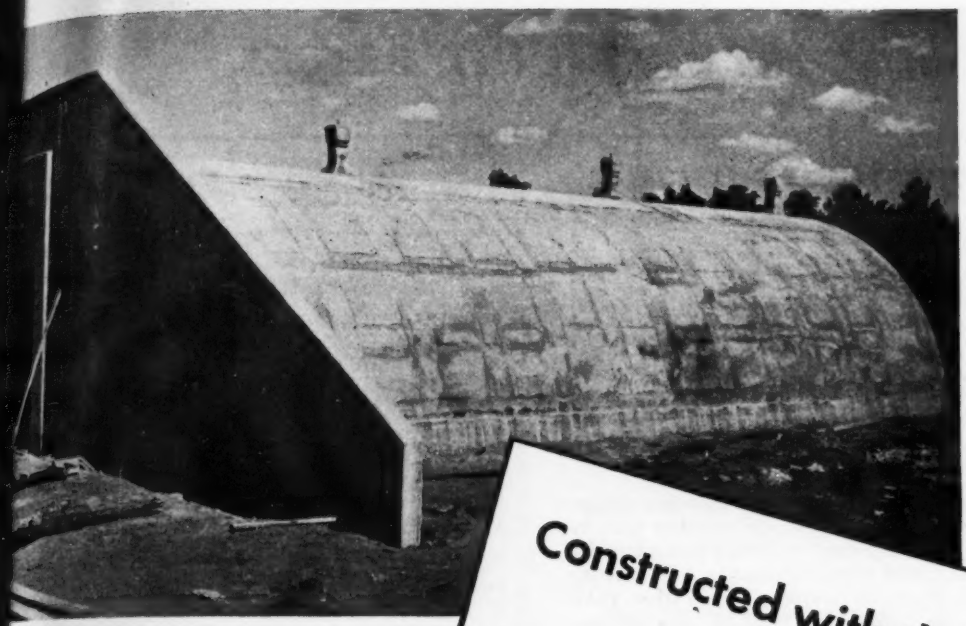
THE YOUNG ENGINEER IN A POSTWA... WORLD—An address by Dean Thorndik... Saville. The Newark College of Engine... ing, Newark, N. J.

THE WAR AND ENGINEERING EDUCATION—... By J. K. Finch. Columbia University, ... New York, N. Y.

ROAD TESTS OF AUTOMOBILES USING ALCO... HOL-GASOLINE FUELS—Bulletin 158, Iowa ... Engineering Experiment Station, Ames, ... Iowa.

SUMMARIES OF YEARLY AND FLOOD FLOW... RELATING TO IOWA STREAMS 1873-1940... Water Supply Bulletin No. 1, Iowa Geo... logical Survey, Iowa City, Iowa.

REPORT ON SIGNIFICANCE OF TESTS OF CO... CRETE AND CONCRETE AGGREGATES—Sec... ond Edition. American Society for Test... ing Materials, Philadelphia. $1.50 to ... non-members.



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HESE important structures had to be built right ... and the right kind of concrete construction lled for RITECURE as the curing membrane.

TECURE more than meets all government specifations as to moisture retention. Repeated tests the ASTM standard 2 inch slab show the following:

97.4% water retention in 24 hours
96.2% water retention in 72 hours
92.4% water retention in 168 hours

addition, RITECURE is the "reactive" type of ring compound, helping to make the surface re durable by a chemical reaction with the lime.

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RITECURE The TRANSPARENT CURE

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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

RECONSTRUCT STREETS, PITTSBURGH

OWNER: Board of Commissioners, Allegheny County, Pa.

PROJECT: Concrete paving work in connection with the reconstruction of Water Street and Duquesne Way begins at point 175-ft. west of Barbeau Street and continues to the east side of Eleventh Street. Consists generally of paving Eastbound Roadway (present Duquesne Way) and portions of streets that intersect it; portions of the approaches to the Sixth, Seventh and Ninth Street bridges; connections from Eastbound Roadway to Westbound Roadway and River Boulevard; and all grading and other work incidental to completion of paving, including maintenance of traffic.

CONDITIONS: Contractor to furnish all materials except chain-link fence and 1-in. water meters, and complete work in 120 calendar days. Rail, highway and water transportation facilities available to site of work. Project has AA-3 priority rating. Wage rates in Pittsburgh area are: skilled labor, $1.50 to $1.90 per hour; semi-skilled, $1.00 to $1.25; and common, 80 to 90c.

LIST OF BIDDERS: (Bids received Feb. 9, 1943)

1. Dinardo, Inc., Pittsburgh, Pa. (contract) $248,418
2. McCrady Construction Co., Pittsburgh, Pa 254,437
3. M. O'Herron Co., Pittsburgh, Pa 255,794
4. Nardulli & Sons Co., Pittsburgh, Pa 325,041

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation, Class I	2,000 c. y.	$1.50	$2.50	$1.50
2. Remove, dispose of exist. pavmt. in all new roadway areas	16,500 s. y.	.50	1.00	.30
3. Preparation of subgrade of roadway pavmts. laid on conn. roadways	1,700 s. y.	.25	.30	.30
4. Concrete, Cl. A; light pole found'n	57 ea.	50.00	26.00	40.00
5. Wood anchor bolt covers	108 ea.	12.00	4.50	20.00
6. Concrete, Cl. A; traffic islands	35 c. y.	20.00	23.00	30.00
7. Remove and dispose of undisclosed artificial underground structures	10 c. y.	15.00	10.00	5.00
8. Embankment; granulated slag	16,000 c. y.	.80	1.10	1.30
9. Concrete, Cl. A-e; encasing steel columns	3 c. y.	60.00	75.00	40.00
10. Concrete, Cl. B; retaining wall	7 c. y.	60.00	40.00	35.00
11. Conc., Cl. A-m; sidewalks on grade	55,000 s. f.	.35	.35	.35
12. Conc., Cl. A; base course in street railway area (8-in.)	1,500 s. y.	3.25	3.75	4.50
13. As above, 6-in. thick	1,500 s. y.	3.10	2.75	4.00
14. Conc., Cl. P; 4-in. surf. crse. in str. railway area	3,000 s. y.	3.25	2.50	2.50
15. Conc., Cl. P; spec. 1-crse. pavmt. (10-in.)	17,500 s. y.	4.00	4.10	5.20
16. Conc., Cl. P; spec. 1-crse. private entrance pavmt., 8-in. thick	850 s. y.	4.00	4.00	4.50
17. Conc., Cl. A-m; curb	5,500 l. f.	2.00	1.90	2.00
18. Conc., Cl. A-m; curb with underdrain	4,300 l. f.	2.50	3.40	2.75
19. Conc., Cl. A-m; curb with underdrain, and 6-in. perf. clay pipe	800 l. f.	2.75	2.80	3.00
20. Reset precast concrete curb	500 l. f.	1.25	1.50	1.00
21. Reset precast conc. curb. with underdrain	320 l. f.	1.75	2.00	1.75
22. Cement (substitute HES for standard in conc. if ordered)	5,000 sacks	.25	.17	.20
23. 12-in. rein. conc. pipe culvert	430 l. f.	3.25	3.90	3.50
24. 12-in. clay pipe culv. (extra str.)	96 l. f.	3.25	3.70	3.50
25. 12x12-in. clay pipe wyes	10 ea.	3.00	20.00	6.00
26. Brick catch basins, Types 1 and 1-A	4 ea.	225.00	230.00	200.00
27. Brick catch basins, Type 1 (incl. all castings)	7 ea.	225.00	230.00	200.00
28. As above, Type 4	3 ea.	225.00	225.00	200.00
29. As above, Type 6	1 ea.	225.00	240.00	200.00
30. Brick storm inlets, Type 1 and 1-A	4 ea.	175.00	210.00	175.00
31. Brick storm inlet, Type 5	1 ea.	175.00	220.00	175.00
32. Brick storm inlet, Type 6	1 ea.	175.00	230.00	175.00
33. Brick storm inlet, Type 1 (incl. all castings)	10 ea.	175.00	210.00	175.00
34. As above, Type 4	1 ea.	175.00	220.00	175.00
35. Brick manholes	4 ea.	200.00	220.00	175.00
36. Extra depth of catch basins	35 l. f.	15.00	22.00	20.00
37. Extra depth of storm inlets	10 l. f.	15.00	18.00	20.00
38. Extra depth of manhole	30 l. f.	15.00	35.00	20.00
39. Raising catch basins, storm inlet or manhole castings	10 l. f.	15.00	18.00	20.00
40. Lowering catch basin, storm inlet or manhole castings	5 ea.	10.00	35.00	20.00
41. Brick masonry in doorway opening	10 c. y.	60.00	40.00	40.00
42. Underdrain	1,000 l. f.	1.00	.85	1.00
43. Concrete vault, Type B	35 ea.	50.00	150.00	100.00
44. Concrete vault, Type C	10 ea.	50.00	175.00	100.00
45. Wood handrail post with iron castings	18 ea.	70.00	75.00	20.00
46. Class B conc.; footers for fence	65 ea.	5.00	5.00	10.0
47. Remove, re-erect chain-link fence	600 l. f.	1.00	2.00	2.00
48. Complete demolition of 1-story bldg.	Lump Sum	250.00	150.00	100.00
49. Deliver sound blockstone removed from exist. pavmt: to warehouse	150 M	20.00	35.00	25.00
50. Del. sound stone curb to warehouse	500 l. f.	.75	.60	
51. Del. precast conc. curb to warehouse	800 l. f.	.75	.60	
52. Contractor's tools, plant, equip't. and overhead	Lump Sum	22,000.00	8,000.00	8,0
53. Maintenance of pedestrian and vehicular traffic	Lump Sum	7,000.00	3,850.00	6
54. Provide entrance and exit for vehicles in Joseph Horne Bldg.	Lump Sum	300.00	500.00	5
55. As above, parking garage in Fulton Bldg. basement	Lump Sum	100.00	250.00	2
56. As above, Fulton Bldg. freight entr.	Lump Sum	100.00	250.00	2
57. As above, Spear Co. parking lot	Lump Sum	100.00	300.00	3
58. As above, Nernst Lamp Co. lot	Lump Sum	100.00	300.00	3
59. Vehicular entrances and exits to and from other buildings	2 ea.	100.00	250.00	1
60. Furn., relay 8-in. centr. B. & S. Cl. 250 cement lined c. i. pipe	780 l. f.	4.00	5.60	
61. As above, 6-in.	300 l. f.	3.50	5.30	
62. Furn., install 8-in. hub gate valves	3 ea.	75.00	125.00	1
63. Furn., install 6-in. hub gate valves	12 ea.	55.00	100.00	1
64. Furn., install c. i. deep frames, covers	90 sets	30.00	30.00	
65. Brick masonry (water lines)	130 c. y.	50.00	40.00	
66. Concrete (water lines)	35 c. y.	25.00	35.00	
67. Excavation (water lines)	30 c. y.	3.00	5.00	
68. Fire hydrants	14 ea.	100.00	175.00	1
69. Raise 36-in. AWWA Cl. D, B & S cast iron pipe	675 l. f.	15.00	10.00	
70. Furn., relay 12-in. centr. B & S Cl. 250 cement lined cast iron pipe	408 l. f.	5.00	8.50	
71. Furn., install 12-in. hub gate valves	4 ea.	125.00	225.00	2
72. Reset 1-in. water meter	1 ea.	30.00	30.00	
73. Furn., install cast iron medium extension gate box	1 ea.	30.00	25.00	
74. Furn. and place misc. steel in conn. with work on water lines	2,200 lb.	.10	.15	
75. Furn. and relay 1-in. lead pipe	20 l. f.	4.00	2.50	

BRIDGE RECONSTRUCTION, TEXAS

OWNER: Texas State Highway Commission, Austin.

PROJECT: Reconstruction and repair of two sections Lavaca Bay Bridge across Lavaca Bay on highway betwe Port Lavaca and Palacios, Texas. Portions of the timber p trestle bridge were washed out by storm and are to be replac Overall length of bridge 1.979 miles. Bascule span in cen still in place and connects damaged portions.

CONDITIONS: Operations to be carried on over water w storm hazards present. Contractor to furnish all materi except reinforcing steel, and salvaged lumber and pil Project to be completed in 180 working days. Rail, highw and water transportation facilities available. Wage rates a skilled labor, $1.00 per hour; semi-skilled, 60c.; common, 5

LIST OF BIDDERS: (Bids received Feb. 9, 1943)

1. J. DePuy & Sons, San Antonio, Tex. (tentative award) $402,2
2. Wallace & Bowden, Norman Larson, and Lester Watson, Dallas, Tex. 427,1
3. Ernest Loyd, Fort Worth, Tex 430,0
4. Theo. Jensen & A. A. Pendergrast, Pasadena, Tex 479,4
5. Brown & Root, Austin, Tex 489,2
6. Austin Bridge Co., Dallas, Tex 502,2
7. Bauer-Smith Dredging Co., Port Lavaca, Tex 518,2
8. Heldenfels Bros., Rockport, Tex 564,2
9. H. B. Zachry, Laredo, Tex 576,5

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Class A concrete	2,624.29 c. y.	$22.00	$21.00	$2
2. Reinforcing steel	165,373 lb.	.045	.05	
3. Treated timber laminated deck	390.8 M bm.	160.00	166.00	1
4. Treated timber caps and posts	335.9 M bm.	160.00	185.00	1
5. Tr. timber blocking and bridging	49.5 M bm.	160.00	195.00	1
6. Tr. timber railing (salts)	53.4 M bm.	160.00	200.00	1
7. Place salvaged timber	364.5 M bm.	50.00	75.00	
8. Treated timber (3x10-in. bracing)	15,450 l. f.	.40	.50	
9. Treated timber (pole bracing)	15,450 l. f.	.45	.56	
10. Tr. timber piling, 32-ft.	24,900 l. f.	1.50	1.54	
11. Tr. timber piling, 60-ft.	2,280 l. f.	1.80	1.85	
12. Untreated timber piling	56,940 l. f.	.85	.83	
13. Drive salvaged treated piling	16,800 l. f.	.50	.57	
14. Timber piling pedestals	120 ea.	40.00	26.00	
15. Timber piling splices	1,305 ea.	25.00	26.00	
16. Pile top extensions	115 ea.	30.00	22.00	
17. Raising timber spans	Lump Sum	8,000.00	7,000.00	2,1
18. Pull and salv. piling (32-ft. or greater)	26,558 l. f.	.65	.68	
19. Pull and salvage piling (8 to 32-ft.)	8,000 l. f.	.65	.68	
20. Salvage piling not usable in work	4,000 l. f.	.65	.68	
21. Salvaging lumber	10 M bm.	70.00	60.00	

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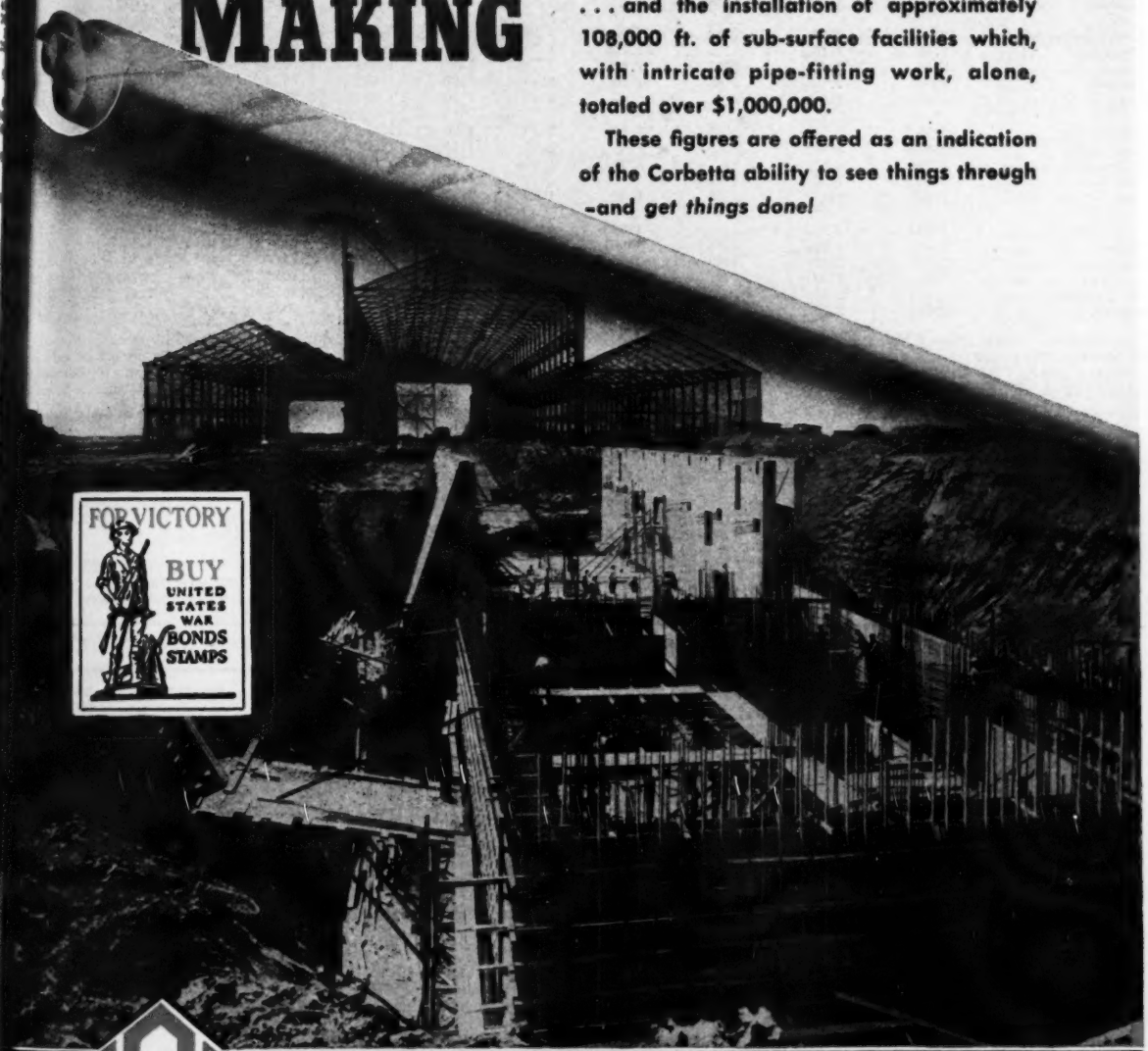
"Yesterday", the site pictured below was a quiet countryside . . . Today, it is part of a tremendous steel production front operation. This unit with eight more, alike in character, comprised a single Corbetta construction assignment . . . All are now adding to the might of America!

This vital project required excavating more than 1,600,000 cu. yds. (unclassified) . . . the pouring of approximately 85,000 cu. yds. of concrete . . . the laying of 7,000,000 brick . . . and the installation of approximately 108,000 ft. of sub-surface facilities which, with intricate pipe-fitting work, alone, totaled over $1,000,000.

These figures are offered as an indication of the Corbetta ability to see things through —and *get things done!*



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OKLAHOMA • NEBRASKA • WEST VIRGINIA • PENNSYLVANIA • OHIO • MARYLAND • DELAWARE • NEW JERSEY

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

MAY CONSTRUCTION material prices and labor rates reveal only minor changes from the preceding month. Paving asphalt climbed approximately $1.00 per ton in both Detroit and St. Louis. Gravel increased 25c. per ton in Detroit. Vitrified sewer pipe prices declined slightly in Cleveland, but were up in Detroit. Wrought steel pipe discounts remain unchanged in New York, but are expected to increase 0.2 points May 15 due to the suspension of the 6 percent freight rate rise for the period from May through December, 1943. Southern pine prices are up in New York as a result of the increased ceiling on 1-in. boards, and due to the fact that most of the incoming planks are 2-in. and must be cut down to the 1-in. size. Another factor is the mixing of lumber, including some of the higher grades, that must be done to complete the orders and overcome shortages.

Common labor in Baltimore is up 5c. per hour to the new rate of 75c. Cincinnati, structural ironworkers now receive $1.67½, and the hoisting engineers' rate ranges from $1.45 to $1.60, whereas, the lower limit was formerly $1.40.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT — Per bbl., carload lots, including 40c. per bbl. for bags, cash discount not deducted			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE — Per ton, carload lots		CRUSHED SLAG — Per ton, carload lots, f.o.b. plant		CONCRETE — Ready Mixed 1:2:4, 50 c.y. or more, delivered
	Cloth Bags *a*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.80	$1.99	$1.79	$1.89	$1.59	$1.69	$8.00
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	7.25
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	5.90
Boston	2.75*b*	2.40*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	7.25*m*
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	6.60
Cleveland	2.40	2.15	....	1.70*i*	1.70*i*	1.60*i*	1.70*i*	1.70*i*	1.75*i*	1.75*i*	7.30*k*
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	6.30
Denver	3.08	2.88	2.68	1.20	1.40	1.25	1.65	1.75	1.00	1.00	7.25
Detroit	2.40	2.15	2.00	1.65	1.65	1.20	1.63	2.00	2.20‡	2.45‡	6.50
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	7.50*m*
Los Angeles	2.80*s*	2.20*e*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	7.25
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	7.10
Montreal	....	1.95*rs*	1.79*rs*	....	....	1.30‡*t*	1.05‡*et*	1.15‡*et*	....	....	7.90*h*
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	9.25
New York	2.66‡	2.41‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	7.90*k*
Philadelphia	2.33	2.08	1.88	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	8.20
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	8.25
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*gw*	.75*gw*	8.00
San Francisco	....*u*	2.22	1.92	1.36	1.36	1.36	1.46	1.46	....	....	7.50
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu.yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Price withdrawn. *w* 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* No market.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not returnable

	Bagged	Bulk		Bagged	Bulk		Bagged
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.80
Dallas, Tex. (Inc. 10c. tax)	1.85	1.80	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80
Hannibal, Mo.	1.70	1.65	Norfolk, Va.	1.75	1.70	Universal, Pa.	1.65
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex. (Plus 10c. tax in Tex.)	1.75
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.)	1.68
						Discount 10c per bbl. 20 days	

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICKS AND BLOCKS — Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	PAVING ASPHALT — Per ton, less than 80 penetration: Tank car	Drums	ASPHALT BINDERS—FLUXES — Per gal., 80–300 penetration: Tank car	Drums	CUTBACK ASPHALT — Per ton: Tank car	Drums	ROAD OILS — Per gal.: Tank car	ASPHALT EMULSION (Quick-breaking) Per gal.: Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.40*e*	$24.62*e*	$0.0787*e*	$0.1309*e*	$0.0876*he*	$0.1348*h*	$0.0676*e*	$0.0826	$0.1
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	.07*r*	.1
Birmingham	.....	32.00*j*	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09	....
Boston	80.00	55.00	3.75	14.20	20.00	.06	.09	.065*h*	.115*h*	.065	.09‡	.12
Chicago	150.00	55.00	1.80/2.00*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/.10*n*	.13/.15
Cincinnati	112.00	37.00	.....	16.40	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	118.00	37.50	2.25	19.00	23.50	.10	.11	.09*h*	.105	.08	.10	.12
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07
Denver	.....	27.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	37.50	.....	18.06*f*	25.60*f*	.0743	.128	.0718*h*	.119*h*	.067	.0755	.12
Kansas City	.....	40.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.16
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	.11
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	.....	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.16
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	.....
New York	.....	70.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	.12
Philadelphia	130.00	58.00	4.06	15.00	.....	14.00	.....	.065*h*	.....	.....	14.00*g*	.....
Pittsburgh	135.00	38.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis	.....	37.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.1213*h*	.048	.0705	.12
San Francisco	.....	70.00	.....	9.50	18.75	9.50*gr*	18.00*gr*	10.00	17.50*r*	9.50*g*	.0525	.12
Seattle	.....	60.00*c*	.....	10.90*i*	19.40*i*	.....	20.40*gi*	11.40*i*	.....	10.90*i*	.0525*i*	.09

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martines. *j* 3x3½x8½ in. *k* Tax included. *m* thousand. † Available on priority only and quoted specially. *p* No steel for shipments except to armed forces. *r* February 1943 prices, none later available.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std. Spikes *c*	Tie Plates *c*	Track Bolts
ingham...	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15	$4.75
ago.....	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
burgh.....	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15	4.75
alo.....	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15	.....
eland.....	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....	.....
estown...	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....	.....
oit.....	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ports.....	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....	.....
ific ports...	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30	.....

‡Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c.l. ar points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City,

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq.yd., carload lots Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq.yd., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 lb. base price
nta.....	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
timore.....	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	3.00
mingham.....	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	....
ton.....	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
ago.....	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
cinnati.....	3.68	2.53*cd*	2.53*cf*	.....	.05	19.50	21.50	1.66	1.25	.1566	....
veland.....	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	....
as.....	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	....
ver.....	4.35	3.95	3.85	.....	....	26.50	28.50	1.97	1.45	.186	....
roit.....	3.65‡	2.52‡	2.52‡	.....	.10	25.50	29.50	1.68	1.26	.1584	2.66
ss City.....	4.00	2.64*cd*	2.64*cd*	.0	.05	19.60	23.60	1.78	1.33	.1683	2.89
Angeles.....	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
neapolis.....	3.80‡	2.75	2.75	.0	.10	25.00	27.00	1.80	1.34	.1701	2.75*d*
ntreal.....	4.00*i*	2.90*i*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.56*i*	3.14*i*	.268*i*	....
Orleans.....	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1715	2.875
York.....	3.75	2.76*e*	2.76*e*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
adelphia.....	3.65	3.85	....	.....	....	19.50	21.50	1.71	1.28	.1611	2.75
burgh.....	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
Louis.....	3.69	2.7575	2.7575	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
Francisco....	4.35	2.825	....	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
ttle.....	2.75*e*	2.50*e*	....	.....	....	34.50	38.50	1.93	1.42	.1827	2.95*ej*

‡Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. k. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new t and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *k* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
nta.....	$49.66	$0.26*b*	$0.468*bc*	$1.8525	$4.38*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.2
timore.....	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54.5
mingham.....	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2
ton.....	55.40	.26	.463	2.07	5.85	140.00	.....	.60	.....	....	....	....	....
ago.....	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0
cinnati.....	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	39.6
veland.....	54.75	.196	.378	1.62	4.715	81.00	125.00	.36	1.40	68.5	57.5	66.0	54.5
as.....	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3
ver.....	61.56	.29†	.52†	2.16†	3.00*m*	130.00	240.00	.50	1.70	58.4	50.4	55.7	47.2
roit.....	54.75	.252	.486	2.09	7.16	78.00	127.00	.36	1.60	57.7	44.0	54.8	40.6
ss City.....	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.8	46.3	46.0	59.7
Angeles.....	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	48.6
neapolis.....	59.00	.275†	.495†	1.98†	5.14†	.....	.....	.90	2.10	64.0	53.0	60.5	49.0
ntreal.....	60.00	.85	1.50	5.25	8.50*e*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	....	....	....	....
Orleans.....	51.78	.26	.48	1.69	.....	150.00	220.00	.40	2.10	62.4	54.4	58.8	50.3
York.....	52.40	.322	.621	2.43	6.15	.....	.....	.60	1.40	64.7*	53.7*	62.2*	50.7*
adelphia.....	51.00	.28	.54	2.30	6.75	150.00	225.00	.45	1.75	56.4	42.6	53.3	38.9
burgh.....	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5*i*
Louis.....	52.84	.28	.504	2.016	4.50	85.00	220.00	1.00*j*	2.15*k*	56.4	42.6	52.5	38.1
Francisco....	68.40	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.58	2.34	46.0	32.0	42.0	27.0
ttle.....	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	.....

‡Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and r Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton litional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices f.o.b. mill. Base price $200 per net ton. List prices per ft.; ¼ in., 8½c.; ½, 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. ercent tax on transporation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe. * Discounts, increase 0.2 point May 15.

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Fox. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for size &
	All Fir planks No. 2 common, fir timber is No. 1 common. Lengths up to 90 ft. (Prices in italics)											
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R/A	6x12 R/A	12x12 R/A	2x12 R/A	12x12 R/A	¼"
Atlanta	**$32.00**	**$32.00**	**$29.00**	**$28.00**	**$28.00**	**$31.50**	**$46.00**	.....	.....	$54.00	$62.00	$17.90
Baltimore	**40.00**	**42.00**	**40.00**	**40.00**	**41.00**	**44.00**	**60.00**	.....	.....	110.00	115.00	18.25
	45.00	*46.00*	*52.00*	*52.00*	*52.00*	*52.00*	*68.00*	*$72.00*	*$72.00*	.....	.....	.....
Birmingham	**34.50**	**36.50**	**32.00**	**32.00**	**34.00**	**34.00**	**53.00**	**53.00**	**56.00**	.....	.....	17.35
	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	.....
Boston	‡*	.....	50.00[3]	55.00[3]	.....	.....	.....	.....	.....	.....	.....	18.25
	‡* *45.00*	*45.00*	*50.00*	*55.00*	*60.00*	*70.00*	*75.00*	*80.00*	*80.00*	.....	.....	.....
Chicago	**42.00**	**43.00**	**41.00**	**40.00**	**41.00**	**42.50**	**60.00**	.....	.....	80.00	95.00	14.60
	50.00	*50.00*	*47.50*	*47.00*	*47.00*	*48.00*	*57.00*	*56.50*	*58.00*	.....	.....	.....
Cincinnati	**41.00**	**42.50**	**39.00**	**40.50**	**42.00**	**43.00**	**53.00**	.....	.....	65.00	68.00	17.35
	.....	.....	.....	.....	.....	.....	*55.50*	*55.50*	*55.50*	.....	.....	.....
Cleveland	**42.50**	**42.50**	**52.50**	**51.00**	**51.00**	**54.00**	**78.00**	70.00	70.00	.....	.....	17.75
Dallas *e*	**39.50**	**40.50**	**39.50**	**38.00**	**38.50**	**39.50**	**53.50**	**53.00**	**53.00**	78.00	83.00	14.60
Denver ‡	54.00[4]	52.00[4]	55.00[4]	55.00[4]	55.00[4]	56.00[4]	59.00[4]	*73.00*	*79.00*	.....	.....	10.45
Detroit	**44.00**	**44.00**	**44.00**	**43.50**	**44.00**	**46.00**	**60.00**	.....	.....	53.00	63.00	17.35
	.....	.....	.....	.....	.....	*51.50*	*55.00*	*60.00*	*60.00*	.....	.....	.....
Kansas City	**50.00**	**55.00**	**52.00**	**52.00**	**52.00**	**55.00**	**65.00**	.....	.....	75.00	85.00	12.60
	50.00	*55.00*	*52.00*	*52.00*	*52.00*	*55.00*	*65.00*	*80.00*	*80.00*	.....	.....	.....
Los Angeles *a*	*55.00*	*55.00*	*53.00*	*53.00*	*51.00*	*51.00*	*57.00*	*65.00*	*66.00*	.....	.....	9.90*h*
Minneapolis ‡*b*	49.00[3]	49.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60
‡	*53.00*	*53.00*	*53.00*	*52.00*	*52.00*	*53.00*	*59.00*	*61.00*	*61.00*	.....	.....	.....
Montreal ‡*j*	*52.00*	*55.00*	*48.00*	*52.00*	*54.00*	*60.00*	.....	.....	.....	200.00	200.00	.....
	42.50	*42.50*	*45.25*	*45.25*	*45.25*	*46.75*	*50.00*	*50.00*	*50.00*	.....	.....	.....
New Orleans	**31.50**	**31.50**	**33.75**	**31.75**	**34.00**	**35.00**	**48.00**	.....	.....	69.00	69.00	14.60
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....
New York ‡*j*	**60.50**	**61.50**	**56.25**	**55.25**	**56.25**	**59.50**	**67.50**	.....	.....	120.00*f*	125.00*f*	18.35
‡	.....	.....	*65.00i*	*65.00i*	*65.00i*	*65.00i*	[Range from $75 to $95]			.....	.....	.....
Philadelphia	**50.75**	**50.75**	**51.75**	**50.00**	**50.00**	**52.75**	**70.00**	.....	.....	110.00	107.75	18.25
	.....	.....	*65.00*	*65.00*	*65.00*	*65.00*	*67.50*	*$75 to $95*	*$75 to $95*	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	18.10
	69.20	*68.10*	*66.10*	*65.80*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	.....
St. Louis ‡*c*	**51.00**	**51.00**	**49.00**	**48.00**	**49.00**	**52.00**	**66.00**	*72.00*	*72.00*	84.00	71.00	14.60
San Francisco *d*	*35.50*	*35.50*	*37.00*	*37.00*	*36.50*	*36.50*	*40.50*	*49.50*	*49.50*	.....	.....	7.30*g*
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, [illegible] 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. [illegible] Seattle base price on ⅝", $95.15; on ¾", $104.85; price includes oiling and [illegible] ing charges. For other centers add rail freight increment from table or [illegible] size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by [illegible] shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69. *j* Average [illegible]

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938, Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	75%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	71–10%	71–10%	.15	
Cleveland	77–10%	77–10%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*e*	
Detroit	77%	77%	.1575	
Kansas City	76–10%	76–10%	.155	Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40–5%‡	47%‡	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	76–10%	76–10%	.155	
San Francisco	66–15%	73–15%	.155	
Seattle	75%	75%	.1575†	

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers' list Sept. 15, 1928. ‡ Plus sales tax.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered [illegible] barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short Leaf — Barge
12 in. at butt	6 in.	30 to 50 ft	...
12 in.— 2 ft. from butt	6 in.	50 to 59 ft	...
12 in.— 2 ft. from butt	6 in	60 to 69 ft	...
14 in.— 2 ft. from butt	6 in.	50 to 69 ft	...
14 in.— 2 ft. from butt	6 in.	70 to 79 ft	...
14 in.— 2 ft. from butt	5 in.	80 to 85 ft.	...
14 in.— 2 ft. from butt	5 in.	85 to 89 ft.	...

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00*a*	3.00	$3.50
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.90
	Mixed Oak	1.71	2.59	2.42	3.30
Birmingham	White Oak	1.00	1.60*a*	1.30	2.25
	Southern Pine	....	....	....	....
Chicago	Red Oak	....	2.19*a*	....	2.87
	Southern Pine	....	....	....	....
Los Angeles	Douglas Fir	1.10	1.75*a*	1.60	2.50
Philadelphia	Red Oak	....	2.10*ag*	....	3.25
St. Louis	White Oak	1.65*	....	1.90*	....
	Red Oak	1.55*	2.15*a**	1.90*	2.70
	Sap Pine or Cypress	1.35*	....	1.70*	....
San Francisco	Douglas Fir	1.15*bef*	....	....	3.00
Montreal	Birch or Maple	.85	.95	....†	....

Tr.— Treated; Untr.— Untreated. *a* Creosoted *b* 6"x8"x8'6". *c* [illegible] cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. * September [illegible] price, OPA ceilings effective. *g* January price, none later available.

CHEMICALS

Water, sewage treatment road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.50– [illegible]
Chlorine cylinders, liquid, per lb. delivered	[illegible]
Calcium chloride, 77–80%, flaked, in 100-lb. paper bags, delivered, per ton	18.50–[illegible]
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	[illegible]
Soda ash, 58%, in paper bags, per 100 lb. dense	[illegible]
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–[illegible]
Sulphate of copper, in bbl., per 100-lb.	5.00– [illegible]

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in	8x12x12 in	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity. Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized, or lump
anta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.00	$26.50	$15.04	$15.04
timore	84.00	90.00	170.00	200.00	260.00	320.00	15.00*k*	19.00*k*	18.00	13.00	2.50*m*
mingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.25*le*
ston	89.35*a*	93.30*a*	178.70*a*	202.50	271 80	308.20	16.50*i*	19.50*i*	17.50*t*	12.50*t*	14.92*t*
icago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.50
cinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.50	13.00	.....
veland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75*j*	13.25*j*	3.00*jm*
las	62.50	67.50	135.00	162.00	212.50	263.00	13.50*i*	15.00*i*	19.00	15.00	.95*n*
ver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	17.00	25.00*j*	17.00*j*	20.00*j*
roit	86.05	91.80	172.10	213.00	268.00	330.00*e*	17.50	18.00	18.00	16.00	16.00
nsas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	15.50	16.50	19.32	13.00	10.92
Angeles	73.50*tr*	89.50*tr*	128.00*ctr*	210.00*tr*	368.00*tr*	460.00*tr*	13.50	15.00	16.50	17.50	17.50
neapolis	81.95*b*	87.40*b*	148.70*b*	.....	179.30*b*	249.35*b*	13.60	15.00*g*	21.00	16.00	19.00
ntreal	99.10*a*	105.65*a*	154.75*a*	104.65*at*	154.75*au*	155.25	24.10*tu*	27.25*tu*	24.60*u*	18.00*u*	.....
Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	15.00*v*	.....	20.00	14.00	17.00
adelphia	90.00	97.70	183.20	197.10	243.20	301.10	17.00	20.00	15.75	9.00	11.50
burgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.55*m*
Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	24.00
Francisco	84.00	94.50	225.00	.....	.....	.....	17.50	22.00	20.00	20.00	16.40
tle	115.00	125.00	230.00	.....	.....	.....	20.00*f*	21.00*f*	20.00*s*	20.00*s*	20.00*s*

a Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not F.o.b. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* 2% discount for cash. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *s* December price. *t* 5½x8x12. *u* 8% sales tax included. *v* April price. bearing. elected common.

PAINT, ROOFING—F.O.B. CARLOAD LOTS

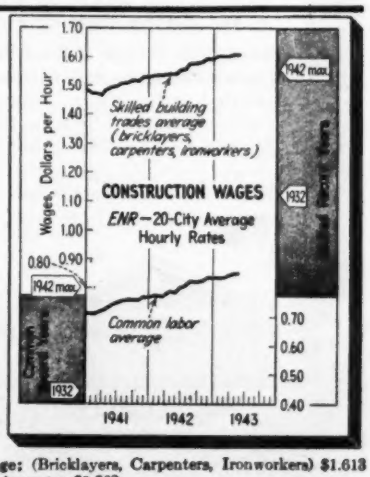
	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
anta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
timore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
mingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.35
ston	10.00	13.75	1.60	....	2.40	2.12‡	1.72*h*‡	1.72*h*‡	.50‡	20.00‡
icago	10.00	13.75	....	....	....	1.75*hf*	1.74*hf*	1.82*hf*	.33*f*	23.00*f*
cinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
veland	10.00	13.75	2.10	4.80	1.95	1.93	1.83*h*	1.83*h*	.35	29.00
las	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.00
ver	10.50	14.25	1.65	....	.27*l*	2.45	3.15	3.15	.35	28.00
roit	10.00	13.75	1.75	3.00	1.60	2.10	2.06	2.06	.35	23.00
nsas City	10.00	13.875	2.39*g*	2.55*gr*	2.16*gn*	2.10	2.30	2.30	.28	27.50
Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
neapolis	10.00	13.875	....	....	....	1.75*i*	1.66*hi*	1.66*hi*	.32	23.00
ntreal	9.25	6.25	2.50*p*	4.90*p*	3.15*p*	2.67	2.07	2.07	.94	1.85*h*
York	10.00	13.75	2.03	....*r*	1.64	1.66	1.58*h*	1.58*h*	.26	25.00
adelphia	10.00	13.75	....	....	....	1.75	1.66	1.66	.32	23.00
burgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.57	1.66	1.66	.28	22.00
Francisco	10.25	14.00	1.80	2.75*n*	1.35/2.35	1.71	2.40	2.40	.33	19.50
ttle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.50*j*

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price charges. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per 100 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb. *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* Plus 8% sales tax. *r* Not available, except on priority rating; then quoted specially. *s* December price.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor—Building	Common Labor—Heavy Const.
lanta	$1.50	$1.25	$1.375	$1.25	$1.50	$0.40	$0.50
ltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
rmingham	1.75	1.125/1.25	1.50	1.25/1.50	1.50	.65	.65
oston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
hicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
ncinnati	1.75	1.50	1.675	1.45/1.60	1.625	.85	.85
eveland	1.75	1.55	1.75	1.75	1.75	1.00	1.00
allas	1.625	1.25	1.50	1.75	1.625	.60	75/1.25
enver	1.65*b*	1.50*b*	1.625*b*	1.43*b*	1.51*b*	.80*b*	.80*b*
etroit	1.675	1.50	1.75	1.625/1.75	1.675	.90	.90
ansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
os Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
inneapolis	1.50	1.375	1.50	1.40	1.50*s*	.925	.925
ew Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
ew York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.031	.95
hiladelphia	1.90	1.50	1.90	2.00	2.00	.825	.825
ittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
t. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
an Francisco	1.75	1.50	1.75	1.50/1.75	1.75	.95	.95
eattle	1.78	1.48	1.68	2.00	1.78	1.08	1.10
ontreal	.965	.855	.90	.80	.945	.505	.505

b 7 hr. day. *e* 30 hr. wk.



ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.613
ENR Common Average: $0.863

Cleanliness CUTS CASUALTIES

Our armed forces everywhere are also fighting dirt and disease—frequently more dangerous than bullets. Mobile laundry units are provided, with small gasoline engines as a part of the power equipment. One more "service star" for rugged, dependable Briggs & Stratton engines, now serving our armed forces in many ways.

ONCE again we want to urge every one here back home who owns or operates Briggs & Stratton 4-cycle, air-cooled gasoline engines, to do everything possible to keep them at top efficiency. Not only will extra service be gained, but the critical materials that would be needed in unnecessary repairs will be saved.

Whether these engines are on farms, in industrial plants, on construction or road jobs, or in army camps—they are all doing their part in the war program — and deserve extra care right now.

Keep your Briggs & Stratton gasoline engines clean, properly adjusted, well lubricated, and in repair. Your nearest dealer or Briggs & Stratton Service Station will be glad to help you.

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ENLIST YOUR DOLLARS
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WAR BONDS

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BRIGGS & STRATTON
GASOLINE ENGINES

NEWS OF THE WEEK

(*Continued from p. 91*)

Mississippi deepening plans now before Congre

According to Senator John H. Over of Louisiana, a move has been started both branches of Congress to deepen Mississippi River from Cairo to Ba Rouge, a distance of 843 miles. Ma Eugene Reybold, chief of engine would be requested to report on feasibility of the project by resolu submitted to the Senate Commerce C mittee. A similar resolution was s mitted to the House Flood Cont committee by Chairman Will M. Wh tington of Mississippi. Senator Over said that the widening and deepening the intra-coastal canal makes it appe that similar action on the river wou aid war and postwar traffic and shou facilitate the growing commerce, not on on the Mississippi River itself but al on connecting waterways as well.

• • •

Bulk of FPHA war housin built for temporary use

More than 98 percent of the war hou ing units assigned to the Federal Publ Housing Authority for development du ing recent months represented temp rary construction and are scheduled f dismantling after the war, Commissione Herbert Emmerich has announced.

Approximately 163,000 units of a types were programmed by the Nation Housing Agency for construction wi government funds between Oct. 1 of la year and March 15. Temporary co struction is involved in 160,300 of thes units; 1,200 units are leased units; 50 demountable types, and only 1,000 re resent permanent construction. Most o the 1,000 permanent units are federal aid, low-rent projects converted to wa housing for the duration rather tha projects financed directly by appropri ations.

It was originally contemplated tha about 25,000 of the 205,000 units in cluded in this war housing progra would be family dwelling units of pe manent construction, with the remain der to be temporary family units, do mitories or trailers, stated Mr. Em merich. However, in actual experience much higher proportion of temporar construction was built.

The FPHA is accomplishing thre important wartime objectives in thi

ilding program: (1) temporary con-
uction assists in conservation of crit-
l war materials of from 30 to 40
rcent per unit; (2) protection against
er-building of communities is afforded
those localities unable to absorb
rmanently the housing built for spe-
ic wartime needs; (3) production of
se temporarily constructed family
its at a low cost ranging from 35 to
percent lower than required for per-
nent construction.

To implement further its policy of
mporary construction for war housing,
FPHA places its temporary projects
leased sites wherever possible, rather
n on purchased land, Mr. Emmerich
ted. This policy provides economy
d also facilitates the removal of tem-
rary structures after the war, he said.

. . .

Pacific Northwest wants increased electric power

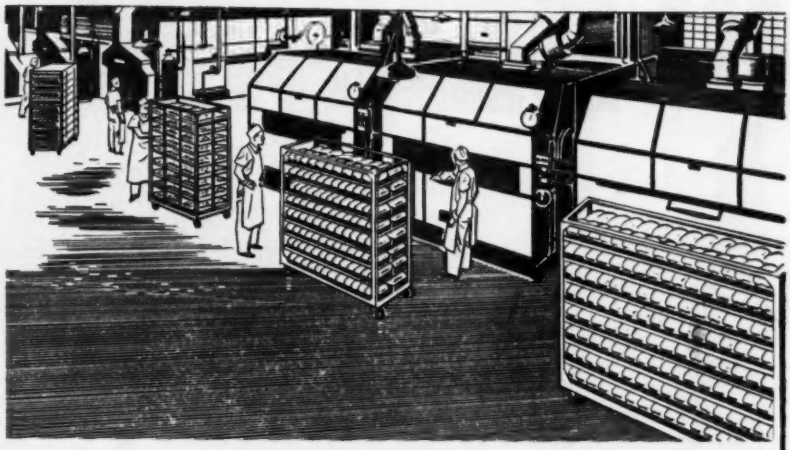
Recommendations for the development
new power facilities in the Pacific
rthwest capable of providing 300,000
400,000 kw. of additional capacity are
ntained in a recently released resolu-
on by the Bonneville Advisory Board,
der Paul J. Raver, power adminis-
tor. The board recommended quick
mpletion of scheduled units of Bon-
ville and Grand Coulee dams and the
mediate installation of hydroelectric
nerating facilities already approved.
was also recommended that construc-
on be started immediately to complete
e Rock Island Dam on the Columbia
iver.

In accordance with the board's reso-
tion, the War Department is conduct-
g an engineering investigation to form
e basis for recommendations regarding
e location and design of a dam on the
lark Fork, a branch of the Columbia
iver, which would provide initial
orage at Lake Pend Oreille of 3,000,-
00 acre-ft. Immediate construction of
e Umatilla project for navigation, irri-
tion and power development on the
olumbia River was also recommended.

. . .

Buffalo, N. Y. water front plan under controversy

A veto of the Moffat bill, passed re-
ntly in the New York Legislature, and
der which the state would assume the
st of developing Buffalo's water front,
s been requested of Governor Thomas
Dewey, by Mayor Joseph J. Kelly of
ffalo, N. Y. On the other hand the
iagara Frontier Planning Board
rongly urges gubernatorial approval of



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FLOATING FLOORS—used a lot in bakeries—have a hardwood surface over a treated wood subfloor. Sand between this and the concrete serves as a cushion. These floors stand up well under the wear and tear of service. The heavy pan trucks and racks roll more easily on them. The floors are warm and quiet, contributing to happier working conditions.

WOLMANIZED LUMBER* is used for many of these floors, as well as for roof structures, shipping platforms and the like. It provides resistance to decay and termite attack. So, although conditions favor these enemies of wood—high humidities, warmth and frequent wettings for cleaning—this construction has long life.

USE OF THIS long-lived lumber introduces no unusual problems. The speed with which hundreds of Army and Navy projects have been erected is evidence that Wolmanized Lumber goes up easily and fast. All of the advantages of working with wood are retained—low cost, light weight, strength, resilience, good insulating properties. It is clean, odorless and paintable.

ORDINARY WOOD, deeply impregnated with Wolman Salts* preservative by the vacuum-pressure method, becomes Wolmanized Lumber. Service records covering millions of feet, some of it in service over eighteen years, prove its lasting ability. The low upkeep costs that result certainly warrant your considering Wolmanized Lumber for postwar construction. American Lumber & Treating Company, 1649 McCormick Building, Chicago, Ill.

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THE EBERHARD FABER PENCIL WITH THE MICROTOMIC LEAD ...IN 18 DEGREES... AND 6 DEGREES ALSO WITH CHISEL POINT LEADS

the measure. The bill, which met w
no opposition in the Legislature, p
vides for expanding the Niagara Fr
tier Bridge Commission's authority
initiate construction of a bridge or tun
for Buffalo River, and amends the l
to empower the state to finance a hi
speed highway from Athol Springs
Niagara Falls.

The Mayor's opposition was based
the argument that in surrendering Fu
mann Boulevard and canal rights-of-w
the city would receive no compensati
for large sums which it has expend
A vigorous attack on the Mayor's co
tention that the transfer of the canal l
lands to the state will be made "witho
consideration" to the city, was made
Chauncey J. Hamlin, chairman of th
Niagara Frontier Planning Board. H
further stated that it was the first ti
such a golden opportunity had be
offered to solve Buffalo's water fro
problem.

. . .

Total projects stopped by WPB $1,327,286,920

The total cost of construction projec
halted through the revocation of prefe
ence ratings during the week ended Apri
9 was $45,654, according to an announce
ment of the War Production Board. Du
ing the same period, preference rating
were restored to projects having a tota
cost of $3,413,484, which had been pr
viously halted.

The above figure brought to $1,327,
286,920 the total value of all construction
projects which have been halted by th
War Production Board or the program
ming agency since the Facility Revie
Committee was established last October
29 to examine the relationship of con
struction projects to the war program.

. . .

State housing authority planned in Connecticut

A state housing authority, having the same powers as local authorities but acting only in areas where there is no such local authority, is being considered in the Connecticut legislature. Consisting of five members serving six year terms without compensation, this body will operate in municipalities where recognized housing shortage exists and where no local municipal housing authority is operating.

The state housing authority will also investigate and collect information regarding local projects, aid local authorities, study war and post-war dwelling needs, stimulate city planning, encour-

investment of private capital in low-cost housing and study the use of credit by loan or subsidy for housing projects. This body will also be authorized to accept federal grants.

. . .

New pipe line near Akron

To prevent serious shortages of natural gas next winter in the Akron area, the War Production Board has recently granted the East Ohio Gas Co. preferential priority on 22,500 tons of steel for the construction of a 120-mi. pipe line, which will greatly augment that area's dwindling gas supply. Costing $3,250,000 this pipe line, which is to be laid between Brecksville and Maumee, Ohio will be capable of bringing between 50,000,000 and 100,000,000 cu. ft. of gas to that district when completed next August, according to J. French Robinson, president of the gas company. Fifty miles of the pipe line is expected to be completed this month.

. . .

Big gas tank for scrap

Five million pounds of scrap iron and steel, nearly enough to construct the hull of a heavy cruiser, will go to war soon, it has been announced by the Consolidated Edison Company of New York. Scheduled to be dismantled is one of the city's oldest gas tanks, which was built at Twelfth St. and the East River in 1895. The structure, with a capacity of 100,000,000 cu.ft., has been turned over to War Materials, Inc., and will be demolished by wreckers at once.

. . .

"Oceanarium" is proposed for New York City

Tentative plans for a huge oceanarium or aquarium to be constructed after the war on a site owned by New York City adjacent to the Coney Island Boardwalk have been made by the city and the New York Zoological Society. The new oceanarium will go much farther than merely to replace the old aquarium at Battery Park whose destruction in order to make way for approaches to the proposed Battery-Brooklyn tunnel was vigorously opposed by various civic and architectural groups. The razing of the old structure was approved by the Board of Estimate last September and its action was recently upheld by the Appellate Division of the New York Supreme Court, after opponents of demolition had failed in a lower court suit to enjoin Park

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On pole line construction, an Ohio public utility reported a 40% reduction in hole cost and an increase in productivity per man of 108%!

When time is short and labor hard to get, you can't afford to overlook the speed and economy you'll get from BUDA Earth Drills. Write or wire NOW for your free copy of the BUDA Earth Drill bulletin.

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Commissioner Moses from razing the structure, and the state court of appeals has denied an injunction. The building was closed to the public on Oct. 1, 1941, and the exhibits were moved to the Bronx Zoo or disposed of otherwise. The estimated cost of the proposed oceanarium, according to the City Planning Commission, is $1,502,000.

. . .

New irrigation district established in Mexico

President Manuel Avila Camacho has decreed the establishment of another national irrigation system to surround the Teptitlan Dam in the state of Mexico, near Mexico City. This reservoir behind the dam, which has a capacity of 20 million cubic meters of water, had not been used to the fullest advantage for agriculture of the region, the decree explained, and therefore it was decided to create the irrigation district which will be financed by federal farm banks.

. . .

Women truck drivers for highway department

As evidence of the present shortage of manpower, more than 100 women will be trained by the state highway department of Oregon as truck drivers, within the next four weeks, according to R. H. Baldock chief engineer. The feminine truck drivers will work with oiling and paving crews. It is reported that a few women already are working as section gang helpers on the highways.

BRIEF NEWS

Col. William W. Wanamaker, chief of the Denison (Tex.) district of the U. S. Engineers, has announced that prisoners of war will be used in clearing land in the Denison Dam basin. The first prisoners are expected shortly. Sixteen thousand of 30,000 acres of land must be cleared by this fall.

The New York City Housing Authority has announced the reappointment by the Mayor of Mary K. Simkhovitch as a member of the Authority for a new term of five years. Mrs. Simkhovitch has been a member since the establishment of the Authority in 1934. During that time 14 public housing projects have been built

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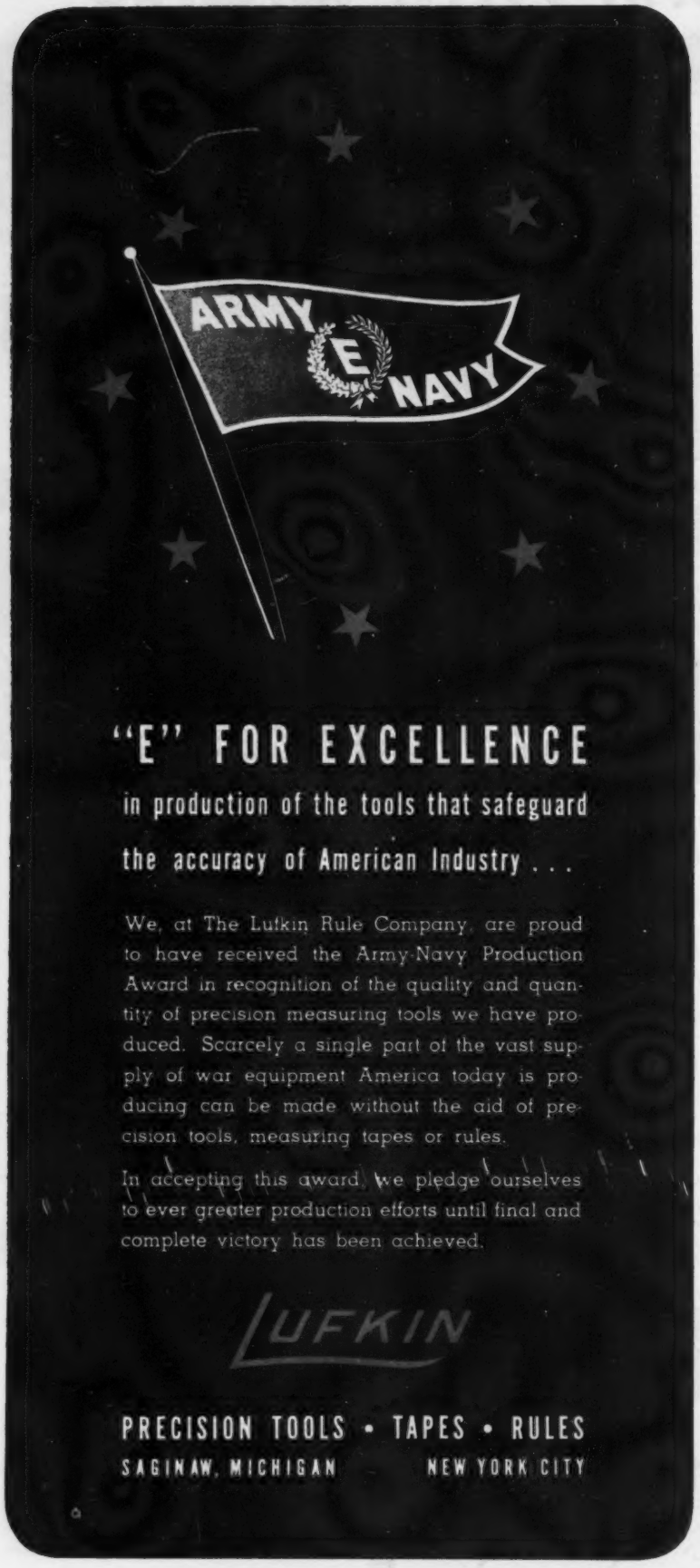

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We, at The Lufkin Rule Company, are proud to have received the Army-Navy Production Award in recognition of the quality and quantity of precision measuring tools we have produced. Scarcely a single part of the vast supply of war equipment America today is producing can be made without the aid of precision tools, measuring tapes or rules.

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costing approximately $90,000,000 a housing over 17,000 families. In ad tion, financing contracts have been sig for 11 postwar projects, with an e mated development cost of about $2 000,000.

Canadian wartime housing of a to value of $69,500,000 has been comple or is in the contract stage, it was a nounced in the Canadian Parliam recently. Wartime Housing Ltd. b tween August 1, 1940 to February 1943 has let contracts for 3,869 hous five staff houses with accommodation 440 men, eight women's hostels with a commodation for 2,778 women, and t bunk houses with accommodation f 250 men.

Maintenance superintendents of t Pennsylvania highway department, w established safety records of from on to three years without lost-time acc dent were called together recently an given plaques commemorating the achievement. Presentation of the plaque was made by Secretary John U. Shroye Those who received them were C. W Branthoffer, Lahman D. Lamber Harold Shuey, Spencer Roberts, Leste D. Wise, Earl J. Madden, Charles K Matthews, Aaron D. Leitzell, Robert J Noll, T. S. Schmitt, H. C. Anderson John R. Quigg, Richard M. Haines Hugh Rooney, Warren E. Bachman, G H. Seigworth, W. J. Dieffenderfer, an William W. Gibb.

President H. J. Cody of the Univer sity of Toronto has announced that un dergraduate registration in the faculty o applied science and engineering is to be restricted for the next session, as a war emergency measure, to 600 students. Normal registration in the engineering faculty is between 200 and 300 but the number of students admitted has in creased steadily since the start of the war, reaching an all time high of 606 freshmen last September.

Brig. Gen. John J. Kingman, of the Corps of Engineers, has expressed the belief that had the New Jersey "missing link" in the Atlantic inland waterway been in existence since Pearl Harbor the nation would have saved the $187,- 000,000 estimated construction costs through reduced ship losses. He told the House Rivers and Harbors Committee that that was his personal opinion. However, the Port of New York Au thority has gone on record as being opposed to the diversion of men and materials to construct the ship canal across New Jersey during the war. Walter P. Hedden, one of the Port Au-

city directors, said his board was not sympathetic to the canal, but that use of manpower and critical materials at this time was a "dubious proposition."

Legislative approval of a $9,357,000 improvement program to be carried out at Commonwealth institutions has been asked by the State Administration of Pennsylvania. The program provides for work at Somerset, Philadelphia, Woodville, Embreeville, Norristown, Fairview, Warren, Ashland, Blossburg, Hazleton, Mount Mountain, Philipsburg, Scranton and Shamokin State Hospitals.

The formal opening of the 180-mile pipeline constructed at a cost of more than $4,000,000 to bring approximately 10,000 barrels of gasoline to Richmond, Va., daily from Greensboro, N. C., occurred on April 15. Adequate facilities for handling the gasoline at the Richmond terminal, a $3,000,000 waterfront project on the James River, are expected to help greatly toward improvement of highway traffic.

The incorporation of the McLaughlin Construction Co., of Livingston, Mont., highway contractors, was completed shortly before its president, E. W. McLaughlin, went into service with the army engineers. Affairs of the company will be handled for the duration by J. A. Anderson, vice president and superintendent of construction for the last seven years, and by R. L. Anderson, secretary for the last seven years.

The War Production Board has authorized the resumption of work on two Civil Aeronautics Authority airports, one at Longview, Tex., and the other at Devil's Lake, N. D., which had been halted through the revocation of preference ratings in January.

The Vought-Halpern Construction Corp., Mount Vernon, N. Y., has opened a New York City office at 18 East 41st St.

To supply water needs of an estimated near-future population of 100,000 in Ogden, Utah, and vicinity, a report by Reid Jerman, engineer in charge of the Salt Lake project planning office of the U. S. Bureau of Reclamation, recommends the enlargement of the Pineview reservoir by 50,000 acre-ft. An interesting statement in Mr. Jerman's report is that "The comparison of water requirements in Provo, Ogden, Salt Lake City

Carver Model 3651 (15,000 GPH) unwatering an excavation in Florida.

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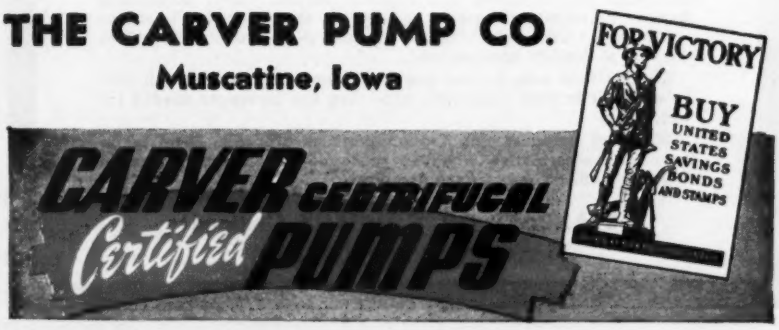

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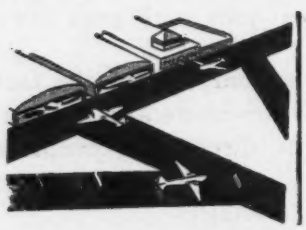

Adequate landing fields are urgently needed. Safe, all-weather Asphalt runways can be laid quickly. In most instances local material can be used, which further speeds up the work, and reduces the cost of Asphalt construction.

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and Denver indicates that the larger the city the lower the per capita requirement for water. No doubt this result largely from the fact that as the population increases the area of lawns and gardens per capita diminishes."

North Carolina State College at Raleigh, N. C., has announced that it will conduct a short course this spring at Asheville, N. C., for training college graduates to hold jobs as junior engineers under the United States Civil Service Commission. The short course will be part of the engineering, science and management war training program being conducted by the college under the sponsorship of the U. S. Office of Education. The course is being arranged primarily for women, but qualified men may enroll.

Less than 18 percent of Canada's known water power resources are developed. Potential turbine installation on recorded water power sites is estimated at 51,350,000 hp., while total actual turbine installation up to January 1, 1943, was only 9,225,823. More than 81 percent of the developed water power is in the provinces of Ontario and Quebec.

Secretary of War Stimson has announced that a new engineer replacement center—Camp Abbot—will be opened at Bend, Ore., May 1. The training unit for the new center will consist of 1,500 officers and men who will move to Camp Abbot from Fort Leonard Wood, Mo., and the camp's first commanding officer will be Col. Frank S. Besson, now at Fort Leonard Wood.

Thirteen concrete piers and two abutments for the new Potomac River bridge between Sandy Hook and Loudon County, Va., are completed, but the bridge cannot be finished until after the war. The bridge is to take the place of two which were destroyed in the flood of 1936. It took 18 months to build the new piers but there is no prospect of topping them with a superstructure because of the need for steel in war industries.

The War Department does not consider construction of a $25,000,000 military supply highway to Alaska through Canadian territory either desirable or a military necessity, Secretary of War Stimson has advised Chairman Robinson of the House Roads Committee. Mr. Stimson said, "The construction at this time of another highway for the same purpose as the existing road is not desirable, nor is it considered to be of military necessity."

THERE is only one Bridge to Peace . . . and that is the Bridge to Victory American workers and fighting forces are building with their common effort. Every job we undertake today is part of that great structure.

Much of our wartime activity has consisted of fabricating and erecting steel structures, the normal products of American Bridge. These include industrial buildings for the manufacture of airplanes, tanks, armor plate and ordnance; mills and plants for the production of such critical materials as steel, aluminum, magnesium, chemicals and rubber; shipyards; hangars; electric power stations.

And with the flexibility so typical of our engineering and operating organizations, we have undertaken also the manufacture of war products not closely related to our normal work —shaped plates and prefabricated sections for cargo ships; flight decks and sub-assemblies for naval craft; gun mount assemblies; cartridge case discs; traveling cranes; and even completely outfitted tank landing ships.

We value the opportunity of taking such a diversified part in war production. But tomorrow, when the Bridge to Peace is complete, you'll find us "doing business at the old stand" as fabricators and erectors of structural steel, better prepared than ever to serve your post-war needs.

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NEW AIDS TO THE CONSTRUCTOR

Conveyor Trough

A new screw conveyor trough, made of a combination of steel trough bottom, wooden sides, and wooden cover board, lag-screwed together to form a complete, tight enclosure for the screw and the material it conveys, has been developed. It is adapted to all standard screw conveyor fittings. It will readily connect with existing steel trough, and can be shipped with sides and bottom assembled. The curved bottom is made of steel no heavier than No. 10 gauge, and has the added advantage of being removable by unscrewing of the lag screws securing it to wooden trough sides, thus facilitating cleaning and replacement.—*Link-Belt Co., 2410 W. 18th St., Chicago, Ill.*

Safety Extension Light

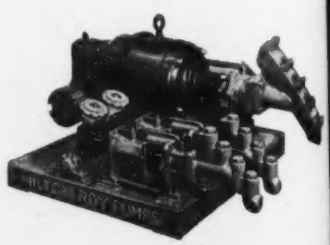
A new safety extension light is offered which is said to be safe against electric shock even when the guard is removed. The light has a guard of heavy fibre and a new type of spring contact. The light is so designed that the guard serves as an on-and-off switch. When it is unscrewed the current is automatically cut off. This light is made of indestructible materials to eliminate the need of repairs and replacements. The device is made of non-conductive materials, removing the hazard of electric shock and the danger of short circuits.—*Davis Emergency Equipment Co., 45 Halleck St., Newark, N. J.*

An Easily Towed Roller

A light weight roller that can be towed by a truck moving at high speed has been developed. It is equipped with hydraulic control that raises the trailer wheels and the roller is then ready for operation. The operator sits in the elevated seat with all controls within easy reach. When the rolling job is finished the hydraulic control lowers the trailer wheels, raises the roller and the apparatus is ready to be transported to the next job. This roller is well adapted for use on construction and maintenance jobs, for airport runways, roads, highways, parking lots, industrial plant roadways, etc.—*Littleford Bros., Inc., 457 Pearl St., Cincinnati, Ohio.*

Pumps for Three Liquids

A special purpose step-valve pump has been developed which delivers three liquids—one heavy, viscous material and two very light materials—at various required rates of flow to control accurately the volume of each in a compounding operation. Features of the pump include three step-valves, one with a single cover plate. All valves have non-clogging, self-



cleaning double ball-checks on both inlet and discharge sides. These are standard type units, with plungers driven by a single motor, variable plunger stroke while operating—all assembled on a special welded steel base. The manufacturers state that their standard step-valve pumps handle practically all processing chemicals, petroleum products, intermediates, food and other slurries as well as fibres and solid in suspension.—*Milton Roy Pumps, 1360 E. Mermaid Ave., Philadelphia, Penna.*

Industrial Glass Tanks

These tanks use a minimum of critical materials, and are not just glass lined but are actually tanks made of glass built up to the required shape and size in heavy tempered glass plates. The

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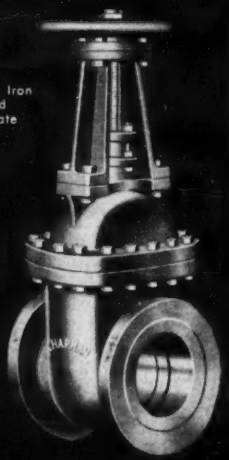
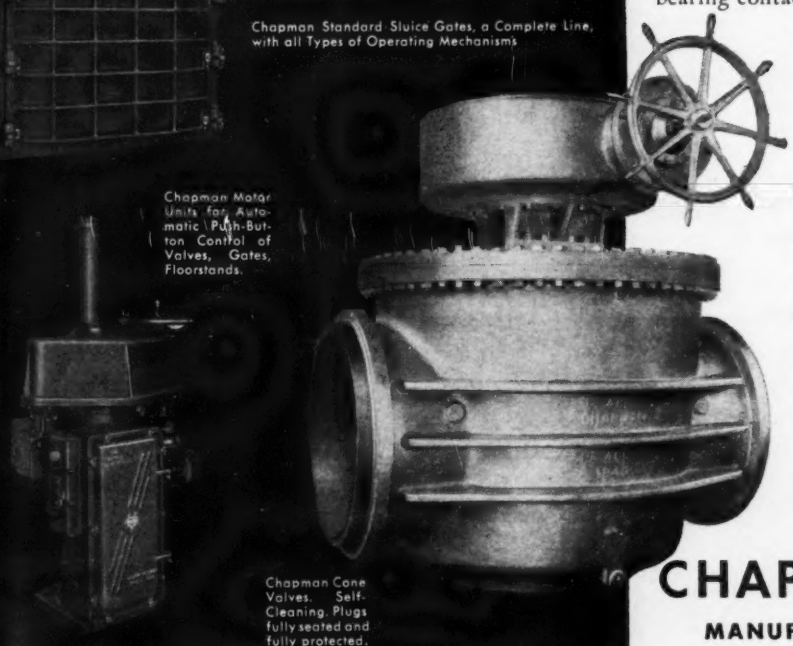
FOR TENNESSEE'S VOLUNTEER ORDNANCE WORKS...

Chapman Beamed Waterway Gate Valve with Hydraulic Operating Cylinder.



Chapman Iron Body, Solid Wedge Gate Valves.

Chapman Standard Sluice Gates, a Complete Line, with all Types of Operating Mechanisms.



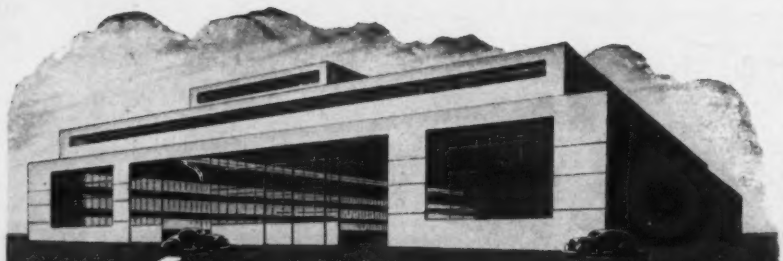
Chapman Motor Units for Automatic Push-Button Control of Valves, Gates, Floorstands.

Chapman Cone Valves. Self-Cleaning. Plugs fully seated and fully protected.

For the new plant of the Volunteer Ordnance Works at Tyner, Tennessee . . . engineered by Stone & Webster . . . Chapman built 92 Beamed Waterway Gate Valves with hydraulic cylinders, in sizes from 10" to 30". This type of valve was developed by Chapman to prevent the excessive wear on seats encountered in double-disc parallel-seated gate valves which, when open, tend to tip the downstream disc into the waterway, leaving small contact between disc facing and body seat ring. In Chapman's Beamed Waterway Valve, extra bearing contact is secured by vertical beams in the downstream port, so the disc can't tip into the waterway, wear the seat rings, and cause leaks.

This exclusive design is a noteworthy instance of Chapman's advanced engineering in all types of equipment for waterworks, sewage, and filtration plants. Chapman always designs and builds for tomorrow as well as today . . . to protect investment and keep maintenance down where it belongs. That's why it pays to "check with Chapman."

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS



6 Reasons for Using "CZC"-TREATED WOOD

VITAL wartime construction of factories, plants and service buildings is being speeded through the use of millions of feet of Chromated Zinc Chloride-treated lumber. "CZC" treatment does not affect wood's natural property of easy fabrication. And it offers these six important features:

1. "CZC"-treated lumber is resistant to decay-producing fungi. "CZC" also improves surface hardness, providing greater resistance to abrasion.
2. Termites, long vicious enemies of wood, are repelled by "CZC" treatment—the wood cellulose becomes unfit as a source of insect food.
3. "CZC"-treated wood has measurable fire-resistant qualities. (Watch for results of new fire tests to be released soon.)
4. Lumber impregnated with "CZC" is clean to handle—does not irritate the skin.
5. No odor is given off by wood treated with "CZC."
6. "CZC"-treated wood is readily paintable for both interior or exterior exposures.

There is ample "CZC" preservative and treating capacity to meet both military and essential industrial requirements. "CZC"-treated lumber adds little to initial construction costs. The reason is simple: "CZC" treatment permits the use of less expensive woods—which become more lasting than better grades untreated. Additional savings accrue as the need for maintenance due to decay is eliminated.

As a helpful wartime aid and postwar planning guide, write for the free book: "Facts About Lumber Treated With Du Pont 'CZC'."

E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Dept., Wilmington, Delaware.

DU PONT

REG. U.S. PAT. OFF.

CZC

CHROMATED ZINC CHLORIDE

WOOD PRESERVATIVE

BETTER THINGS for BETTER LIVING . . . THROUGH CHEMISTRY

result is a rigid, permanent, sturdy ta free from the necessity for maintenan The new method of heat treating gi to the tank material a physical stren four to five times greater than ordin glass, and the glass has a high resista to thermal shock.—*Pittsburgh Pl Glass Co., Grant Building, Pittsbur Pa.*

Pencil Drawing Blue Prints

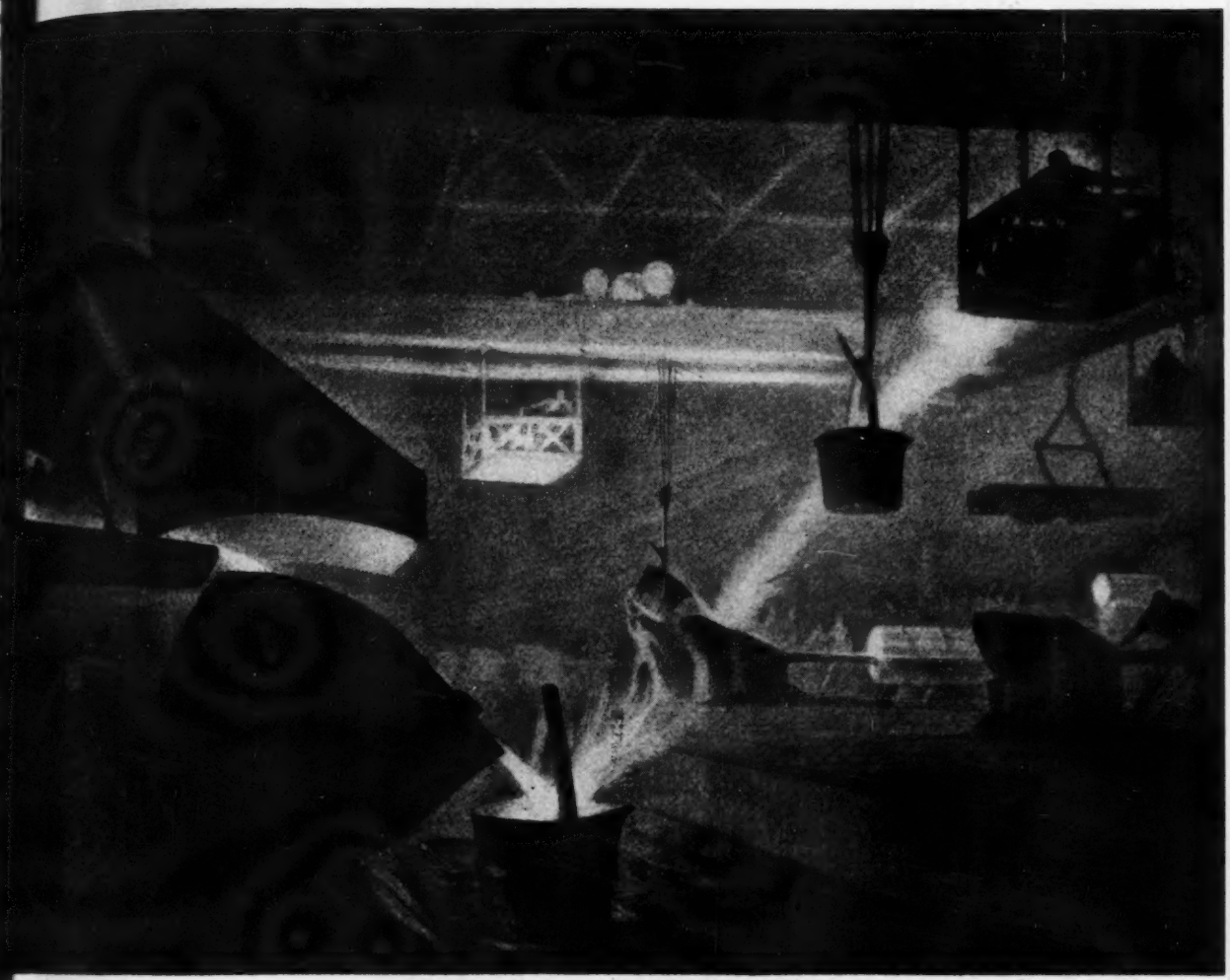
Blue prints made direct from pen drawings frequently lacked the sha clear qualities of prints from inked dra ings. By the use of the No-Ink drawi board top, pencil drawings are said have the sharp definition of an ink drawing. The pencil stroke is a sol even-edged line making blue prints, v dykes, etc., clear, legible and shar edged. Tests over a period of 2½ yea by some of the largest drafting organ zations are said to have revealed a sa ing of 35 percent in operating costs, pl time saved due to earlier use of bl prints.—*W. H. Long Co., 425 Nor Clark St., Chicago, Ill.*

Meter Reading Cards

Some water departments print car that show a facsimile of the meter regi ter dial. These cards are left at premis where the meter reader cannot gain a cess at the time of his regular cal Printed instructions ask the consumer t mark the position of the hands of th meter on the imprinted dial and dro the card in the mail. This practic largely eliminates call-backs, conserv

gasoline and rubber and alleviates t some extent the manpower shortag This Pittsburgh company will furnish free of charge suitable printing plate for any type of Pittsburgh or Nationa meter register, to be used in preparing such cards. In asking for plates, addres the Advertising Department.—*Pittsburg Equitable Meter Co., 400 N. Lexingto Ave., Pittsburgh, Penna.*

The Forehearth



A forehearth in one of our foundries — drawn by Hugh Ferriss.

Molten iron is pouring from the forehearth into a ladle which will be picked up by a crane hook and carried to a Super-de Lavaud centrifugal casting machine. All raw materials in the melt have been inspected and laboratory-checked. The analysis, predetermined. Then, as a further precaution, to insure uniformity of both analysis and temperatures in cupola operation, the molten metal is accumulated and mixed in 12-ton reservoirs called *forehearths*. Variations in speed of melting, iron composition and temperature are thereby reduced to a minimum. This is one of a series of controls in operation at each of our plants, beginning with inspection and analysis of raw materials and ending with tests of the finished cast iron pipe.

UNITED STATES PIPE & FOUNDRY CO.

General Offices: Burlington, New Jersey. *Plants and Sales Offices throughout the U. S. A.*

ON your next job try this UNIFORM welded fabric. It comes to you in rolls or sheets cut to your *exact* specifications, *uniform* in tensile, *uniform* in maximum strength at welds. You save time, trouble and expense on the job, and get higher performance standards. Don't assume that all welded fabric is approximately the same. Learn why other leading contractors and engineers specify *Clinton*.

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Electrically Welded
REINFORCING FABRIC

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JACKSON Hydraulic Concrete Vibrator

DESIGNED TO "TAKE IT" 3 SHIFTS A DAY — EVERY DAY

- Automatic pressure lubrication—requires no attention.
- 34-ft. hose—2¾" vibrator head.
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- Powerful gas engine—4.7 H.P.
- Long-lived, ball-bearing, rotary, hydraulic pump.

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ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN

MANUFACTURERS' ACTIVITIES

The Michigan Tractor & Machine Co. with headquarters in Detroit and branch established at Grand Rapids has been organized to serve as distributor for Caterpillar and allied machinery and equipment in the lower peninsula of Michigan, is announced Caterpillar Tractor Co. The new company is headed by H. O. PENN, president of the H. O. Penn Machinery Co., Inc., New York, and until recently supervisor of the tractor and used construction machinery division of the War Production Board, Washington, D. C.

Chain Belt Co. announces the appointment of WILLIAM W. KLEMME as district manager of industrial sales at Dallas, Tex. Mr. Klemme, previously district manager at Buffalo, N. Y., has been connected with the company since 1937. He is a mechanical engineer graduate of the University of Wisconsin.

ELASTIC STOP NUT CORP. OF AMERICA has launched an extensive advertising campaign designed to familiarize industry and the public with the self-locking vibration-proof stop nut it is producing in large quantities for the war effort. Full-page advertisements in a list of national weekly and monthly magazines will explain the principles of the device and indicate some of the applications to be expected on peacetime products.

The Board of Directors of the Hercules Powder Co. has elected EDWARD B. MORROW as vice president, and named FRANCIS J. KENNERLEY to succeed Mr. Morrow as treasurer of the chemical company. Mr. Kennerley, who was assistant treasurer, will be succeeded by LESLIE W. MASON, present comptroller, and WILLIAM S. HARKINS will be advanced from assistant to the comptroller to comptroller. EDWARD C. HASTINGS will succeed Mr. Harkins as assistant to the comptroller.

The Standard Mfg. Co. of Corning, N. Y., established there in 1886, has moved to its new plant in nearby Big Flats, N. Y., and the name of the organization has been changed to HUNGERFORD

Cleaver Portable Pumping Booster mounted on truck in service of Oklahoma Bituminous Distributing Co., Ada, Oklahoma. This unit is operated in airport and military road construction.

BUILDING the vastly expanded network of auxiliary airports — emergency landing fields and strips — required for our tremendous national aviation training and development program was, and still is, a vitally important —"RUSH"— war assignment.

On scores of such projects Cleaver-Brooks Tank Car Heaters and Bituminous Boosters were on the job — heating the oils and bituminous materials needed.

Construction crews were not delayed, for Cleaver-Brooks equipment circulates and pumps such material after rapid heating to a wide range of application temperatures as required on the job.

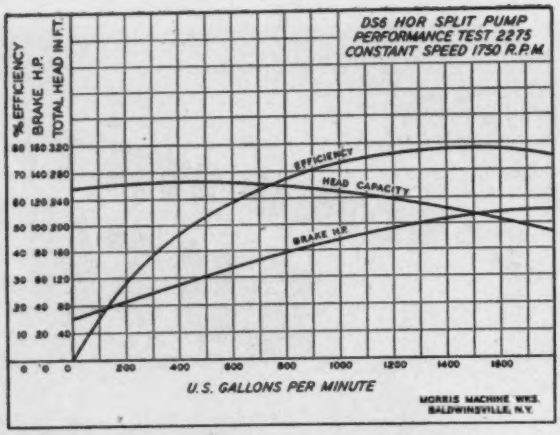
Bituminous boosters and tank car heaters were pioneered by Cleaver-Brooks — hundreds of them are in nation-wide use for airport and road construction and maintenance. They are without equal in speed and economy.

Write for complete information.

CLEAVER-BROOKS COMPANY
5107 North 33rd Street Milwaukee, Wisconsin, U. S. A.

Cleaver-Brooks

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM PLANTS



IN CENTRIFUGAL PUMPS

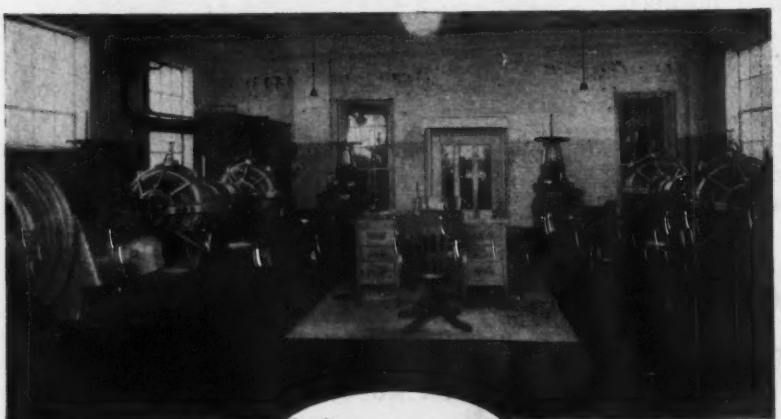
. . . success is a matter of curves

Correct curves of impeller and casing waterway passages result in desirable performance curves of centrifugal pumps.

★ ★ ★ The efficiency curve should reach its highest point at rated operating conditions and should not fall off sharply at capacities above and below normal. The power curve should have a non-overloading characteristic so as not to overload the driver at any point of operation.

★ ★ ★ These and other advantageous features of Morris pump curves are described in bulletin which will be sent on request.

SEND FOR BULLETIN



MORRIS MACHINE WORKS — MORRIS ESTABLISHED 1864 — BALDWINSVILLE NEW YORK

CENTRIFUGAL PUMPS

Corp. The plant is now engaged in a contracting manufacture for the A Air Corps and the U. S. Engineers.

Appointment of Llewellyn Willia vice president in charge of engineeri to head both the engineering and ma facturing divisions of the York Ice M chinery Corp. of York, Pa., has b announced by S. E. Lauer, president the company.

Charles W. Nixon, resident mana of the Bessemer plant, Central Foun Co., Birmingham, Ala., who has b connected with the company and predecessor, the Central Iron & Coal C for the past 35 years, has retired fr service.

Link-Belt Co. has announced the ele tion of Frank S. O'Neil, general ma ager of the company's Indianapolis op ations, to the position of vice-presid Vice-President James S. Watson, I dianapolis, who has just rounded out years of service, plans to retire at t end of this year.

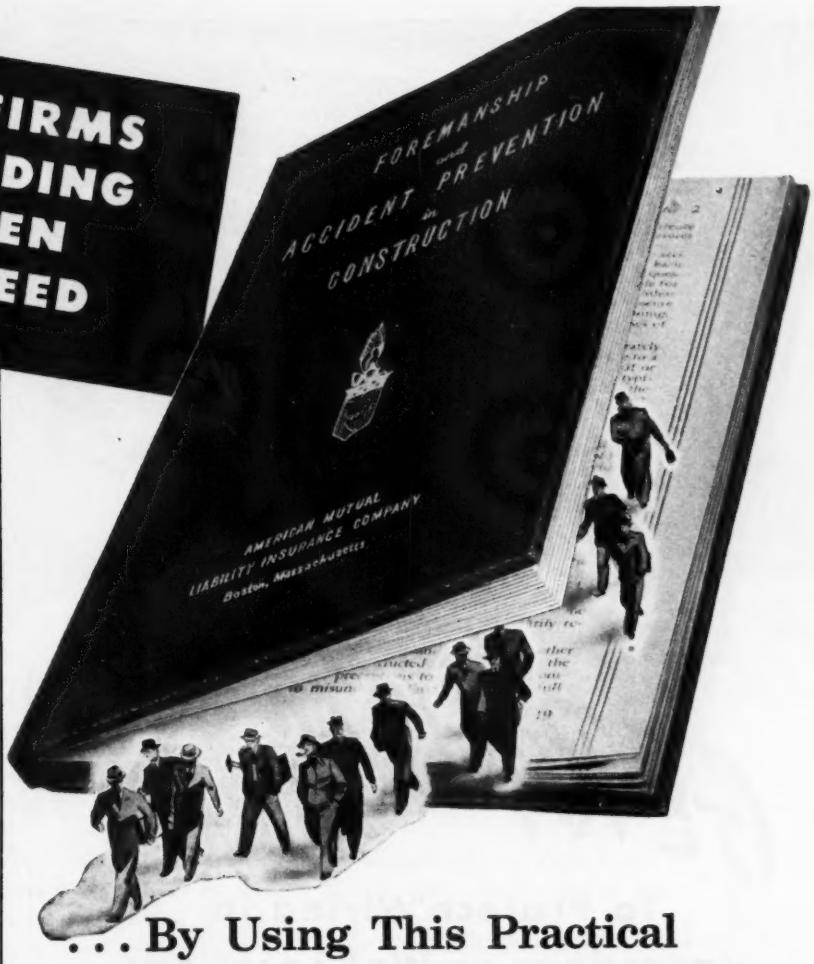
Eugene Frost, assistant general ma ager of the Explosives Department a a member of the board of directors

the Atlas Powd Co., died April 2 at his home Ardmore, Pa. M Frost was appointe assistant gener manager of the e plosives departme Sept. 9, 1942, a was elected to t Atlas board of d rectors Dec. 17 the same year. He had been dire tor of sales, explosives departme since 1932. Mr. Frost had been co nected with the explosives indust for 33 years—first with Jeffers Powder Co., subsequently with the Aet Explosives Co., Grasselli Powder C and Peerless Union Explosives Co., which he was vice president in charg of sales, when that company was merge with Atlas Powder Co. in 1932.

Sidney R. Snow has been appointe assistant to the vice president for ope ations of the American Steel & Wire Co. Cleveland, O. John R. Gaut has be named general superintendent of t Waukegan, Ill., works of the compan succeeding Snow.

Jeff Corydon, well known in th waterworks and sewerage fields durin the last ten years as a pioneer in th development of low cost chemical feeder hypochlorinators and proportioners, ha recently resigned as president of Pr

MANY FIRMS ARE FINDING THE MEN THEY NEED



. . . By Using This Practical Guide to Better Foremanship

"FOREMANSHIP" — published by American Mutual and offered as a war-time service to Industry — is helping many firms to select and train foremen from within the ranks of their present working force, by describing the essentials of a foreman's responsibility and the qualities of mind and character that make for good foremen.

You can also use it as a complete class-room guide, or basis for group discussion. You will find it so thorough and practical on construction problems that even your most experienced men will profit from it and become better fitted for their assignments.

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Chapter I

Foremanship — the foreman's responsibility to his job, to the superintendent, to his men, to his fellow foremen, to subcontractors and the general public; qualities which make for successful foremen 7

Chapter II

The Foreman's Place in Accident Prevention—planning for accident prevention; accident investigation; developing the accident prevention program 15

Chapter III

The Foreman and His Men—selection and hiring, placing and training, supervisory methods 23

Chapter IV

Job Planning — in relation to long range planning, layout of the job, receipt of materials, day-to-day plan 33

Chapter V

Physical Protection — excavation, staging and scaffolding, runways and platforms, barricades, overhead protection, clothing 41

Chapter VI

Care, Use and Storage of Equipment — principles of selection, testing and inspection; rigging, hand tools, supports, derricks, scaffolds, safe practice rules, machine operators, trucks, cranes, moving equipment, moving material, air equipment, machine guards, yard storage, tool storage 51

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Modern, comprehensive coverage fitting your special needs for workmen's compensation, contractor's public liability, fire, automobile, fidelity bonds, and other forms of casualty insurance written by American Mutual and affiliates.

Regular cash dividends which have always saved 20% or more of insurance costs (a big item in your operating costs).

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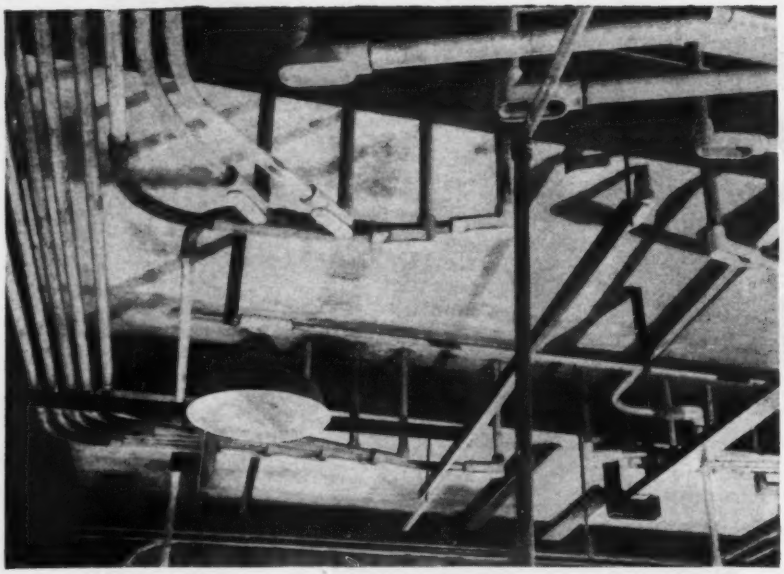

Use G-E Rigid Conduit

To Protect Wiring in Hazardous or Wet Locations

Two G-E rigid conduits are available to help guard against electrical breakdowns in war production plants. Both are high quality. G-E White is hot-dipped galvanized. G-E Black is coated with a corrosion-resistant enamel.

WPB Limitation Order L-225 permits the following uses for rigid conduit: (Type of protective coating is not restricted.)

1. In war implements such as warships, aircraft armament, tanks, etc.

2. In projects rated A-1-J or better for hazardous or wet locations (with conduit size limitations).

Use these protective conduits for maintenance work . . . for conversion wiring . . . for new war wiring. Also G-E electrical metallic tubing and G-E flexible metal conduit are available for use in certain locations in accordance with WPB Limitation Order L-225.

. . . . . .

For further information see the nearest G-E Merchandise Distributor or write to Section C532-113, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

portioneers, Inc., of Providence, R. I., form a new company known as Che Feeds, Inc., also of Providence. Corydon is president of this new co pany. JOHN V. LIZARS is vice presid and manager of the New York office 331 Fourth Ave. The company will ma hypo-feeders, chlorinators, ammoniat and solution feeders for all chemic and uses. It will also render an engine ing service in connection with prop tioning problems.

Robins Conveying Belt Co., Passa N. J., designers, manufacturers and er tors of materials handling machine announces that it is shortening its na to ROBINS CONVEYORS, INCORPORATED

BROR DAHLBERG, president of Celo Corp., and chairman of the board of C tain-teed Products Corp., recently d clared that two-thirds of the natio people are now living in quarters th are inadequate, out-of-date, and in ne of remodeling or complete replacem Part of this, he said, is due to the fa that home building has been halted du ing the war except for the most essent construction which, by necessity, h often been done on the regimented pa tern of housing projects. He predict that at least 1,000,000 new homes a ye will be built in America when the w ends, and sees that building rate co tinuing for ten years.

NOW IN PRODUCTION at Tube Turn Louisville, Ky., is a 30 in. seamle welded elbow to be used in seagoing dr docks for the United States Navy. The are said to be the largest seamless elbo ever made. By using this welded co struction the navy saves erection tim and weight and gains for the drydoc the same superior piping that the new fighting ships now have. This piping h exactly the same aperture all around th curves that it has on the straight-awa and no obstructions. It gives maximu flow and efficiency. With this pipin maintenance is practically eliminated the weld is stronger than the pipe. Ev vibration from bombing, shelling or to pedoing, which in other piping caus leaks far from the explosion point, wi not affect it.

The Kotal Co. of New York has an nounced that PETER MADALONI will ha dle the sale of Kotal in Bermuda, whe the war has brought many change "Paving of the roads is the latest an by far the most revolutionary change the company says, "second only to th introduction of the automobile, for it to meet the demands of military mot transportation that the program for ro improvement has been undertaken."

"GET THERE FIRST WITH THE MOST"

THAT'S war-winning strategy, but one that calls for the biggest material handling job the world has ever seen. Material handling starts with raw materials—it's vital to mill, factory, shipyard output—it's needed on railroads, docks, embarkation points, in Army and Navy bases—it's even a part of today's "front line" action because that's the real answer to "getting there first, with the most."

And when it comes to getting anywhere *first*, with the *most* in speed, power and range of use, the Moto-Crane* stands out by itself. This completely mechanized unit rolls on 10 rubber tires, at truck speeds, with equal ease over highway or cross-country terrain. It's never tied to one spot; it gets around so rapidly, does jobs so quickly and well, it's just like having a crane available *anytime, anywhere.*

"Getting there first with the most" will also win you a lot of battles in post-war competition. That's why it will pay you to investigate the Moto-Crane today.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

LORAIN

***It's not a Moto-Crane unless it's built by THEW-LORAIN**

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Scraper Haulers—A new two-color catalog has been issued to describe a complete line of scraper haulers made by the Sullivan Machinery Co. The line includes two-drum and three-drum models with flange motors or foot motors, portable and heavy duty sizes, and short length and "Lohite" types, all with standard remote or automatic controls. Many models can be equipped with electric or "Turbinair" motors, or gasoline or diesel engine drive, and each model is built in types and sizes to meet any scraping requirement. Ask for Bulletin 76-Y.—*Sullivan Machinery Co., Michigan City, Ind.*

"The Pioneer Story"—This is the title of an interesting illustrated booklet printed in photo-offset to present the organization facilities and services of the Pioneer Engineering Works, Inc. The book shows the company's facilities, the industries served, its product and its personnel. The company is serving the national government in such industries as gravel, mining, the railroads, foundries, and other users of heavy machinery.—*Pioneer Engineering Works, Inc., Minneapolis, Minn.*

Cast Iron Pipe—"Cast Iron Pipe News" is the name of the house organ issued quarterly by the Cast Iron Pipe Research Association. Among the articles in the April issue is an interesting one regarding "Chinese Foundrymen Probably Knew Art of Casting Molten Iron as Early as 1122 B.C."—*The Cast Iron Pipe Research Association, Peoples Gas Building, Chicago, Ill.*

Alloy Steels and Irons—The quarterly "Electromet Review" describes some interesting uses of alloy metals. The leading article is about stainless steel valves directing the flow of vital chemicals.—*Electro Metallurgical Co., 30 East 42nd St., New York, N. Y.*

Electrical Wiring Manual—A new 48-page manual on General Electric wiring for under-floor electrical distribution in cellular steel floors is available for constructors and engineers. Described in this manual are G. E. Q-floor wiring

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RECONDITIONED WITH "GUNITE"

These photos show the disintegrated condition of the buttresses of the downstream face of the Rock Spillway of a power dam of the Central New York Power Corporation Trenton Falls, N. Y., and the reinforcement placed for "GUNITE" restoration of the structure.

Our Bulletin 2200, showing similar and many other types of "GUNITE" work, is available on request.

The "CEMENT GUN" can be bought by anyone, and used without restrictions.

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Manufacturers of the "CEMENT GUN"

ALLENTOWN, PENNSYLVANIA

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LET US BID ON YOUR WORK

Build Hangars, Shops, Barracks

FASTER

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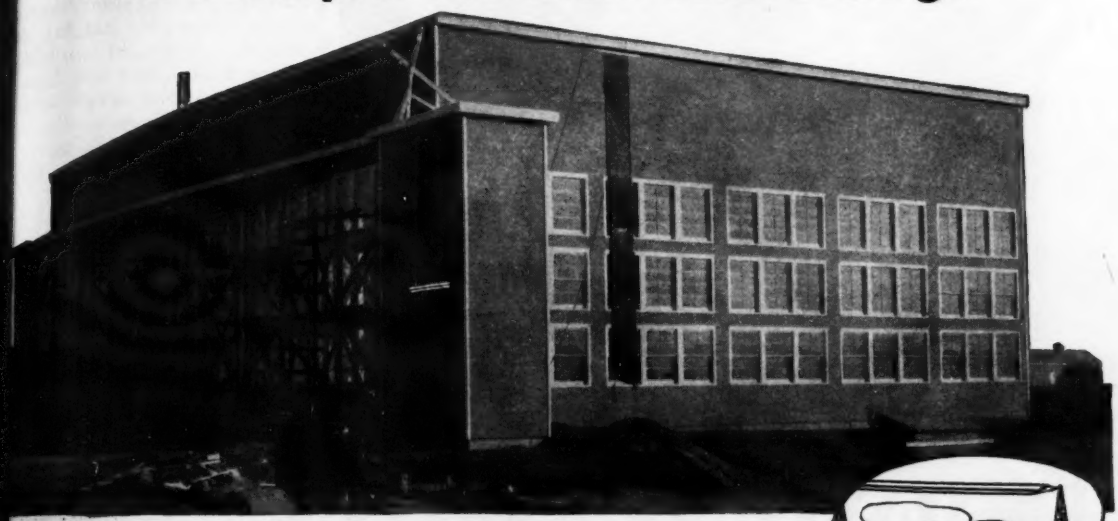

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on in one material—and pro-
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anules for permanent good ap-
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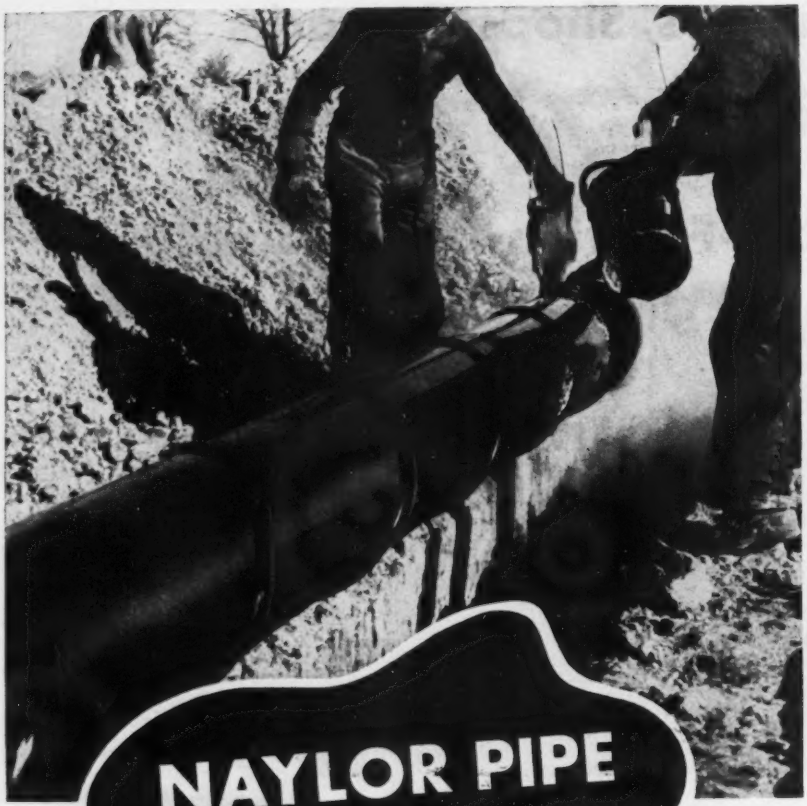

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No other light-weight pipe can match Naylor performance. Naylor's exclusive Lockseam Spiral-weld creates a reinforcing truss that puts this pipe in a performance class by itself. In the contracting field, it is the one light-weight pipe that has the backbone and the stamina to handle jobs normally requiring heavier-wall pipe.

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Light weight saves steel.
Accurate in diameter.
Concentric ends match correctly.
Holds true cylindrical form.
Easier to handle and install.
Absorbs shock loads.
Stays tight and leakproof.
Handles jobs normally requiring heavier-wall pipe.
Cuts maintenance.
High re-use value.
Connections to fit your exact needs.
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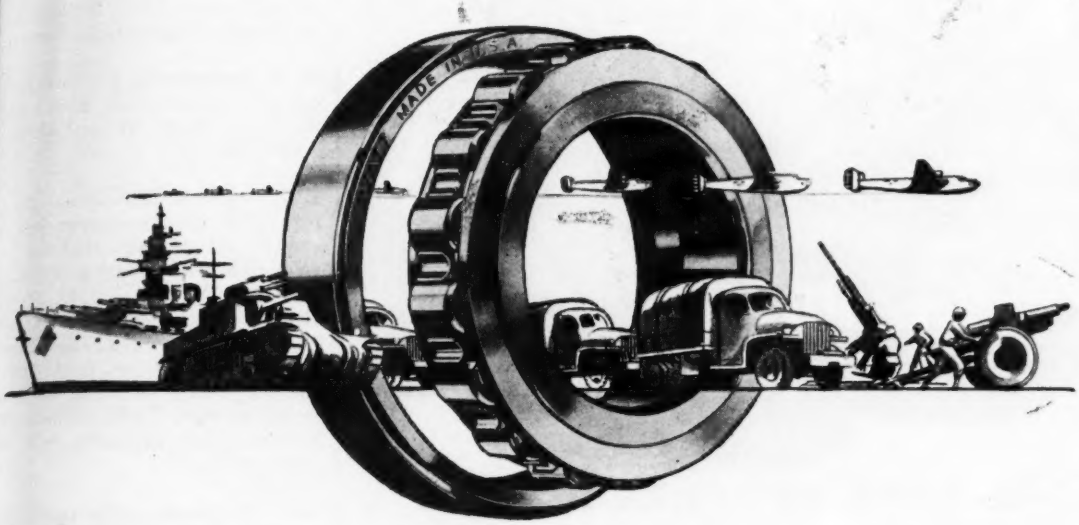

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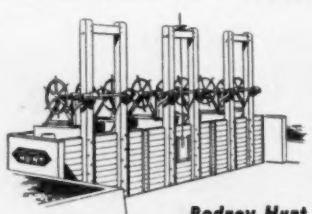

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MEN AND JOBS

W. H. Newell, of Raleigh, N. C., form assistant city engineer and field co sultant for the North Carolina Leag of Municipalities, has been commissione a lieutenant in the U. S. Naval Reser and is now stationed in California.

N. W. Cartwright is a civil engineer charge of construction of an airport Burlington, N. C. for the Fairchild Air craft Corp.

J. J. Goddard, Birmingham, Ala., ha been made chief equipment superinten dent for the Alabama Highway Depart ment with headquarters in Montgomery

Henry Cook, former county engineer Tarrant County, Tex., has been ap pointed lieutenant, j.g., in the Navy an has gone to Norfolk, Va., for training In his absence, R. W. Gibbons, forme assistant county engineer, will act a engineer.

George B. Sowers, of Cleveland, O., con sulting engineer and authority on lake and river improvement, recently received notice that he had been commissioned a major in the provost marshal general's office of the United States Army. He expects to be called to duty around June 1. From 1938 to 1941 Sowers was con sulting engineer for the city of Cleveland in charge of improving the Cuyahoga River.

H. A. Holmstrom, formerly an engineer with the Minnesota State Highway De partment, is now a major in the Air Corps and executive officer at the Army Air Force's bombardier school at Childress, Tex. He has been on active duty since March 4, 1941, having gradu ated from the Adjutant General's School in 1941 and from the Command and General Staff School in 1942. He was post adjutant at Brooks Field, Tex., for more than a year and has had his present assignment since December 1, 1942.

Harry W. Dalby, senior engineer in the military projects division of Denison Engineers, has been transferred to San Diego, Calif., where he will become an engineer in the plant engineering de partment of a war industry.

Henri Gaudefroy has been appointed secretary of the faculty and assistant to the dean at Ecole Polytechnique of Montreal. Mr Gaudefroy has been a member of the teaching staff since 1939. He has a bachelor of science degree from Massachusetts Institute of Tech nology.

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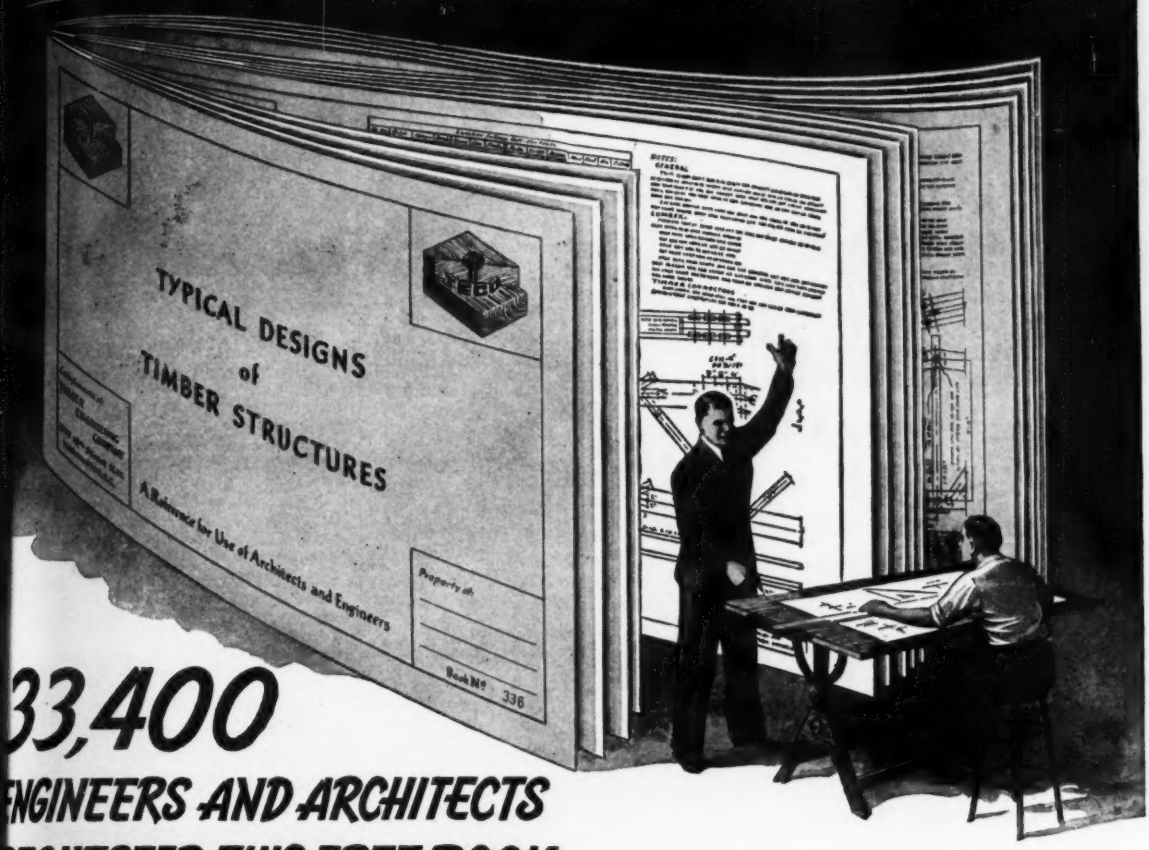

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MEETINGS

AMERICAN ROAD BUILDERS ASSOCIATION, Edgewater Beach Hotel, Chicago, Ill., May 5-7.

AMERICAN WATER WORKS ASSOCIATION, annual meeting Hotel Statler, Cleveland, Ohio. June 15-18.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, 50th anniversary meeting. Chicago, Ill., June 18-20.

AMERICAN SOCIETY FOR TESTING MATERIALS, 46th annual meeting, Hotel William Penn. Pittsburgh, Pa., June 28-July 2.

REGIONAL AND LOCAL MEETINGS

PACIFIC NORTHWEST SECTION, AMERICAN WATER WORKS ASSOCIATION, Bellingham, Wash., May 7-8.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, annual convention, Hotel New Yorker, New York, N. Y., May 7-8.

LEAGUE OF OREGON CITIES, 18th annual convention, Portland, Ore., May 12-13.

MARYLAND-DELAWARE WATER & SEWERAGE ASSOCIATION, annual conference, Lord Baltimore Hotel, Baltimore, Md., May 13-14.

MONTANA SECTION, AMERICAN WATER WORKS ASSOCIATION, Billings, Mont., May 14-15.

HIGHWAY CONFERENCE, University of Tennessee, Ferris Hall, University Campus, Knoxville, Tenn., May 14-15.

PENNSYLVANIA SEWAGE WORKS ASSOCIATION AND PENNSYLVANIA WATER WORKS OPERATORS' ASSOCIATION, Penn Harris Hotel, Harrisburg, Pa., June 8-9.

Elections and Activities

J. G. McGREGOR was elected chairman of the Calgary branch of the Engineering Institute of Canada at the recent annual meeting. Others elected were K. W. Mitchell, secretary-treasurer; executive committee, A. Brownie, H. R. Hayes, A. Higgins, and W. E. Robinson; auditors are W. D. Suitor and F. C. Tempest.

KEITH BOYD, Bismarck, N. D., has been elected president of the North Dakota Society of Professional Engineers.

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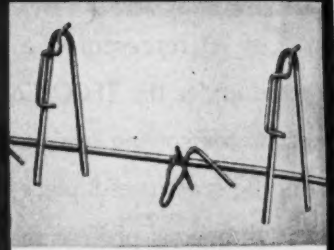

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